International Report on the Methodology, Results, and Recommendations of the European Health Literacy Population Survey 2019–2021 (HLS_{19}) of M-POHL

Report

The HLS_{19} Consortium of the WHO Action Network M-POHL

Gesundheit Österreich GmbH
WHO Collaborating Centre for Health Promotion in Hospitals and Health Care

M-POHL
Action Network on Measuring Population and Organizational Health Literacy of EHII - WHO-Europe

HLS19
Health Literacy Survey 2019
a project of M-POHL

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Vienna, December 2021

Gesundheit Österreich GmbH

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HLS_{19}
Health Literacy Survey 2019
a project of M-POHL

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To be cited as: The HLS_{19} Consortium of the WHO Action Network M-POHL (2021): International Report on the Methodology, Results, and Recommendations of the European Health Literacy Population Survey 2019-2021 (HLS_{19}) of M-POHL. Austrian National Public Health Institute, Vienna

Online publication: https://m-pohl.net/Results

This report contributes to the implementation of the 2030 Agenda for Sustainable Development, in particular to the Sustainable Development Goal (SDG) 3 “good health and well-being”, and the Sustainable Development Goal (SDG) 10 “social inequity”.

Owner, editor and publisher: The HLS_{19} Consortium of the WHO Action Network M-POHL, homepage https://m-pohl.net/

Preface


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Health Literacy cannot be separated from the development of health promotion. In the Ottawa Charter for Health Promotion 1986 many of issues we have later come to explore more deeply through "health literacy" were referred to under the action point "personal skills". In true health promotion thinking these skills were never seen separately from issues of context, equity, participation, and empowerment.

I was able in the late 1990ties – when I joined Yale University – to learn from the US colleagues, who had been developing the field of health literacy, but in contrast to the health promotion debate, initially very much focused on patients within the health care system, but later also on measuring health literate health care organisations. Their focus on tools, data and measurement was very critical.

Returning to Europe I found that in Switzerland where I lived a very first health literacy survey had been developed and my idea to initiative a European survey quickly began to take shape. With the support of many different stakeholders – from industry, the European Commission, public health and academia -this idea was promoted for example at the European Health Forum Gastein and the IUHPE meetings. Finally, the EU was willing to support HLS-EU and a group of highly motivated researchers came together to conduct this groundbreaking work. WHO Europe published the Solid Facts – Health Literacy and this that gave both the concept and results of HLS-EU a high visibility and underscored its relevance for Health for All.

As a next step the German speaking health ministers and WHO-Europe initiated M-POHL, which set the framework for measuring HL regularly in Europe; HLS_{19} could now be initiated and administered. The results of HLS_{19} confirm the initial results of HLS-EU for more countries and for new specific measures. HLS_{19} also offers recommendations for policy, practice and research based on empirical data.

I hope that these results and recommendations will initiate actions in Europe for improving HL and will convince decision makers to plan interventions for strengthening HL on local, national, and European level. Possibly there is even the potential to take the European experiences to other regions of WHO.

It will be critical to invest in measuring population HL again in 2024, as well as support projects for measuring organizational HL. This will require many new dimensions integrating the experiences gained in the COVID19 pandemic, which has driven home the high relevance of health literacy

Prof. Ilona Kickbusch, Founding Director and Chair of the Global Health Centre, Graduate Institute for International and Development Studies Geneva

Preface


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The publication of this Health Literacy Survey (HLS_{19}) report is timely.

Low levels of health literacy among population groups are a challenge for public health, associated with riskier health behaviours and poorer health outcomes. Today, we understand this more than ever before.

Health literacy is an important element of the WHO Regional Office for Europe's flagship initiative on incorporating behavioural and cultural insights, which is central to delivering the European Programme of Work 2020–2025. Prioritizing health literacy alongside other behavioural and cultural determinants of health builds on the commitment made by Member States in 2019, when they adopted a resolution on health literacy, and as part of this agreed to strengthen its measurement, monitoring and evaluation at country and regional levels.

I am pleased that the WHO Action Network on Measuring Population and Organizational Health Literacy (M-POHL) has been leading in this area, supporting a cross-national survey in 17 countries of the European Region, and acknowledge the leadership of Austria in this area.

The data in this report can help build a strong foundation for future action. I hope that its data-driven recommendations will support evidence-informed policy and interventions, and activities we are currently developing in a broader context of behavioural and cultural insights.

This report underlines the value of engaging with and listening to populations to identify and address the challenges that people face in their daily lives, and in using health services. In so doing, we can help to make healthy practices possible, acceptable and attractive. Ultimately, this will contribute to better health and well-being for the people we serve.

Hans Henri P. Kluge, MD, WHO Regional Director for Europe

Foreword


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Health literacy is important for health and health equity. Therefore, Austria decided to join forces with Germany and Switzerland to initiate a European network on measuring health literacy. Austria is grateful and proud that WHO-Europe has adopted this idea by supporting the foundation of the WHO Action Network on Population and Organizational Health Literacy (M-POHL) that came to life in 2018.

The recent European health literacy survey HLS_{19} with 17 participating countries from the WHO-European region is the first project of M-POHL. The results demonstrate that low health literacy is still an area of concern in all participating countries, and that health literacy is associated with a social gradient. This has consequences for personal health-related decisions in the domains of health promotion, disease prevention and health care.

But in times of a pandemic like COVID-19, health-related decisions do not only concern people's individual health; they affect societies at large. Investments in strengthening health literacy are therefore also investments in the overall well-being and prosperity of societies.

Austria has supported the HLS_{19} study because data are important to guide evidence-informed policy and practice in identifying the target groups in most need of support and the areas in most need of interventions. In order to moderate the existing gaps in health literacy, we must specifically focus on the at-risk groups for low health literacy – for example, by taking account of the diverse health information and communication needs of these groups of the population.

Personally, I am convinced that the monitoring of health literacy at regular intervals is an important prerequisite for effectively investing in strengthening health literacy over time.

Therefore, I would like to thank all those whose engagement made M-POHL and HLS_{19} a success. And I do hope that the sustained commitment of the policy and research teams that participated in HLS_{19} will enable the M-POHL network to achieve its aim to institutionalize regular health literacy surveys in a growing number of countries. Austria strongly values the continued guidance of WHO-Europe in further strengthening health literacy in Europe.

Wolfgang Mückstein, MD, Austrian Federal Minister of Social Affairs, Health, Care and Consumer Protection

Short Summary

Background/Research Topics/Partner Countries

In Europe, interest has grown in measuring the health literacy (HL) of the adult population in relation to public health, disease prevention, and health promotion to inform health policy in the new millennium, partly building on a longer tradition of measuring HL, but with a focus on patients, in the US. The European Health Literacy Survey (HLS-EU, 2009-2012) confirmed the relevance of HL for people's health for eight countries in the European Union, and this was replicated in follow up-studies for more European and Asian countries. All of these studies demonstrated that HL is limited in a considerable proportion of the general population, with a social gradient for HL and problematic consequences of limited HL for healthy lifestyles, self-reported health, and the utilization of health care services. Following the recommendations of the WHO's *Health Literacy: The solid facts* (2013), WHO/Europe initiated the Action Network on Measuring Population and Organizational Health Literacy (M-POHL), with 28 countries involved, to measure HL regularly, starting with the Health Literacy Survey 2019 (HLS_{19}). This survey was carried out in 17 countries in the WHO European Region (Austria, Belgium, Bulgaria, Czech Republic, Denmark, France, Germany, Hungary, Ireland, Israel, Italy, Norway, Portugal, Russian Federation, Slovakia, Slovenia, and Switzerland). In the HLS_{19} not only General HL was investigated but also specific HLs, namely Navigational HL, Communicative HL with physicians, Digital HL, and Vaccination HL, using newly developed and validated instruments. Furthermore, HL and health-related quality of life was analyzed as a mediator for health costs.

Methods

The HLS_{19} applied a cross-sectional multi-center survey study design. The study population was defined as all permanent residents aged 18 and above living in private households in the participating countries. A total of 42,445 interviews were included in the study. National sample sizes were expected to be at least 1,000 but varied from 865 to 5,660 respondents. The participating countries used a multi-stage random sampling procedure or quota sampling, and most countries stratified samples by gender, age group, population density, and geographical areas/units. Data were collected in personal, telephone, or web-based interviews, or by using a mix of these. The timeframe for data collection was from November 2019 to June 2021.

To measure General HL across the 17 countries, a short form of the original HLS-EU-Q47 instrument – the HLS_{19}-Q12 – was validated and used. At the same time, new instruments were developed and validated to measure Navigational HL, Communicative HL with physicians, Digital HL, and Vaccination HL which were used by between 7 to 13 volunteering countries. Reflecting the HLS-EU definition for comprehensive, general HL, explicit definitions were drawn up for these specific HLs, and items were selected or constructed based on these. Relevant correlates of HL were also measured in the HLS_{19}. The HLS_{19} instruments were translated into their national language(s) by 16 out of the 17 countries and also into migrant languages by a few countries. For HL

measures, a score was calculated by combining the categories "easy" and "very easy", and standardizing it from 0 to 100, with higher values indicating a higher level of HL. For General HL, four categorial levels were also constructed (excellent, sufficient, problematic, inadequate).

Results/Findings

Psychometric properties of the HLS$_{19}$ instruments: The internal consistency (Cronbach's alpha) of all HL scales was good (Cronbach's alpha). For all measures, and for most countries, the distribution of scores was negatively skewed, with a ceiling effect. Thus, the instruments are sensitive especially for respondents with lower HL. Unidimensionality of the scale was confirmed by CFA and Rasch models, with acceptable results for all scales. Based on moderate correlations with the General HL measure and with each other, all four specific measures are deemed sufficiently independent to measure a specific aspect of HL.

The **most difficult tasks** identified were as follows: General HL: judging different treatment options, protecting oneself from illness using information from the mass media, finding information on how to handle mental problems; Navigational HL: understanding information on health care reforms, judging the suitability of health services, finding out about patients' rights, judging the extent of health insurance coverage; Communicative HL: getting enough time from physicians, expressing personal views and preferences; Digital HL: judging the reliability of information, judging whether information is offered with commercial interests, using information to help solve a health problem; Vaccination HL: judging which vaccinations one needs, finding information on recommended vaccinations.

Disadvantaged vulnerable subpopulations at risk of lower General HL and lower specific HLs than their national averages were identified. Having poor self-perceived health, being financially deprived, and having a lower level in society were indicators for lower General and lower specific HLs. People with a low education also had, on average, lower General, Digital, and Vaccination HL. To investigate a **social gradient**, the indicators gender, age, education, perceived social status, and financial deprivation were used in a linear regression model. A social gradient was demonstrated for all countries, albeit differing in degree across countries. The strongest predictors in the model for a social gradient were financial deprivation and self-perceived level in society for all HLs. Further relevant predictors were education for Navigational, Communicative, and Vaccination HLs as well as age for Digital HL.

Using multiple linear regression analyses, the **potential effects of General HL and specific HLs** were tested. Concerning **General HL**, out of the five lifestyle indicators, significant positive potential effects were shown for physical activity (12 countries), fruit and vegetable consumption (8 countries), alcohol consumption (4 countries), BMI (2 countries), and smoking behavior (2 countries). For three indicators of health status, significant positive potential effects were demonstrated for self-perceived health (all 17 countries), limitations in activities due to health problems (13 countries), and long-term illness/health problems (7 countries). For the utilization of five types of health services, fewer contacts with higher HL were found for GPs/family doctors (9 countries), emergency services (8 countries), medical or surgical specialists (4 countries), inpatient hospital services (4 countries), and day patient hospital services (2 countries). Thus, General HL is relevant for people's health but to a different degree concerning indicators and for individual countries.

Concerning specific HLs, **Navigational HL**, measured in eight countries, had a significant potential positive effect on self-perceived health (7 countries), limitations in activities due to health problems (5 countries), and long-term illness/health problems (2 countries). Higher **Communicative HL**, measured in nine countries, had a significant potential positive effect on self-perceived health in seven countries. **Digital HL**, measured in 13 countries, had a significant potential positive effect on self-perceived health (9 countries) and the utilization of GPs/family doctors (7 countries), when General HL was also included in the regression models. **Vaccination HL** had a significant potential positive effect on self-reported vaccination behavior in five out of the seven countries, a relationship which is at least partly mediated by confidence in vaccinations, risk knowledge, and risk perception.

To sum up, the results demonstrated the **relevance of General and specific HLs** for considerable proportions of adult residents with low HLs, a social gradient for HLs, and significant potential effects of HLs with health-relevant indicators. For all results, there were considerable **variations across countries**, which confirms that HL is a contextual concept and must be measured for each country. Due to the different methods and times of data collection, however, **differences across individual countries** must be interpreted with caution, as must any causal assumptions about potential effects due to the cross-sectional study design.

Recommendations

Based on the HLS_{19} results, the HLS_{19} consortium agreed on a set of recommendations, presented here in a shortened format.

Regarding General HL

- » Health policy should include an investment in longitudinal studies, measuring and monitoring population HL regularly, and should systematically implement interventions to improve HL.
- » Interventions should be specifically targeted at at-risk groups for low HL to reduce the health gap between groups.
- » Interventions to improve HL should focus on all four aspects of processing health-related information (accessing, understanding, appraising, and applying information) within the domains of healthcare, disease prevention, and health promotion.
- » For interventions related to specific, concrete HL tasks, the tasks that are experienced as being more difficult should be prioritized.
- » The quality of health information in the mass media should be improved.
- » Interventions to improve HL in relation to mental health should be prioritized and supported by specific research.

Regarding specific HLs

- Health policy should develop strategies to improve people's Navigational HL, specifically interventions on systemic and organizational levels to make health systems more health-literate, user-friendly, and easier to navigate.
- Interventions to improve the communication of health professionals with patients should have high priority. Specifically, support for health professionals, especially physicians, in dedicating more time to person-centered communication is needed.
- Regarding Digital HL, emphasis on providing easily accessible, high quality, trustworthy, understandable, assessable, and applicable health information, as well as communication via digital sources should be increased.
- Improving Vaccination HL should have top priority, with a focus on judging vaccination information by improving the trustworthiness of information and communication on vaccinations.

Regarding research on HL

- The HL of the adult resident population should be measured regularly in as many countries as possible.
- The next wave of measuring should be planned for data collection in 2024.
- In preparation for this next wave, more specific research should be funded to analyze existing data in more depth as well as to revise, extend, and apply the tools for measuring HL and relevant correlates.
- For the four specific HLs, more detailed analyses and publications on the HLS_{19} data are needed as well as further research and development on improvements for later applications.
- Additionally, further specific health literacies or relevant topics of General HL should be reviewed, selected, and researched to be included in the next wave of measuring HLs.
- More detailed analyses are needed regarding the costs and economics of HL.
- Further dissemination of the results of the HLS_{19} through peer-reviewed scientific publications is required.

Keywords

Health literacy survey, HLS_{19}, recommendations, health literacy measurement

Executive Summary

1. Background/Introduction (Chapter 1)

Relevance of measuring HL in general adult populations and pre-existing research

The relevance of Health Literacy (HL) was first demonstrated for patients' utilization and the outcomes of health care services, primarily by research in the United States of America. The findings encouraged politicians to develop a national action plan for the improvement of HL and practitioners and researchers to develop the concept of a health-literate healthcare organization to deal better with patients with low HL.

Later, the importance of HL was also demonstrated for public health, more specifically for disease prevention and health promotion, and this in relation to the general population and not just for actual patients. In Europe, adult population HL was first measured in a few countries which participated in a US American led study, using the Health Activities Literacy Study (HALS) instrument, and in a single study in Switzerland, using a newly developed experience-based instrument.

The HLS-EU study (2009-2012) offered an integrated conceptual and generic model and definition of comprehensive General HL with a theory-based measurement instrument. Data were collected and analyzed, originally for eight European Union countries, but there were many follow-up studies in individual European countries and in a group of Asian countries. The results of these studies demonstrated the relevance of general, comprehensive HL for public health and health policy. Therefore, the WHO's report *Health Literacy: The solid facts* (2013) recommended the regular, standardized measurement of general population HL, as well as of organizational HL, to investigate how responsive health care and other organizations are to HL. The WHO's Action Network Measuring Population and Organizational Health Literacy (M-POHL) since 2018, followed up on this recommendation and initiated the Health Literacy Survey 2019-2021 (HLS_{19}).

International and national policy documents have highlighted the relevance of HL and recommend measuring and improving HL in practice, both by investing in research and implementing HL policy. By that, global leaders in public health are paying increasing attention to the potential of HL. In 2009, the United Nations Economic and Social Council (ECOSOC) recognized the concept of HL as an "important factor for ensuring significant health outcomes" and called for action plans to promote it. Within the European Region, the WHO's publication *Health Literacy: The solid facts* (2013) summarized important evidence relating to the topic and highlights HL as a key dimension for implementing the WHO's European strategy Health 2020, not least in relation to its potential for promoting empowerment and participation in communities and in health care. At the WHO's 9th Global Health Promotion conference in Shanghai, China (2016), HL was prominently featured, resulting in the Shanghai Declaration on promoting health in the 2030 Agenda for Sustainable Development, declaring HL a critical determinant of health. The Declaration established the link between HL and the United Nation's Sustainable Development Goals (SDGs), calling for the development, implementation, and monitoring of intersectoral strategies at national and local levels for strengthening HL in all populations. The Organisation for Economic Co-operation and Development (OECD) has also worked on HL, drafting a fast-track paper on how HL is addressed by OECD Member States, which was published in 2018. Also in 2018, the Executive Board of the International Union of Health Promotion and Education (IUHPE) ratified a position statement, A Practical Vision for a Health Literate World, supporting HL policy, practice, and research at a global level. Specific attention has also been paid to the potential of HL to reduce the prevalence and impact of noncommunicable diseases (NCDs), as reflected in the Montevideo Roadmap 2018-2030 on NCDs as a Sustainable Development Priority. Within the European Region, former Regional Director Zsuzanna Jakab defined HL as one of the enablers for implementing the Sustainable Development Goals during the 67th WHO Regional Committee for Europe meeting in Budapest in September 2017. In 2019 the Region launched the resolution Towards the implementation of health literacy initiatives through the life course (EUR/RC69/R9) which demands, among others, the promotion of HL with a focus on reducing health inequities and the strengthening of HL measurements and action.

2. Methods

2.1 Study Design (Chapter 2)

In the HLS_{19}, a cross-sectional multi-center survey study design was applied in 17 countries in the WHO European Region: Austria (AT), Belgium (BE), Bulgaria (BG), Czech Republic (CZ), Denmark (DK), France (FR), Germany (DE), Hungary (HU), Ireland (IE), Israel (IL), Italy (IT), Norway (NO), Portugal (PT), Russian Federation (RU), Slovakia (SK), Slovenia (SI) and Switzerland CH).

The study population was defined as all permanent residents aged 18 and above, living in private households in the countries participating in the study. In total interviews from 42,445 respondents were included in the study. National sample sizes varied as follows: AT: 2,967, BE: 1,000, BG: 865, CH: 2,502, CZ: 1,599, DE: 2,143, DK: 3,602, FR: 2,003, HU: 1,195, IE: 4,487, IL: 1,315, IT: 3,500, NO: 2,855, PT: 1,247, RU: 5,660, SI: 3,360, and SK: 2,145.

The participating countries used a multi-stage random sampling procedure or quota sampling, and most countries stratified samples by gender, age group, population density, and geographical areas/units. As a rule, at least 80% of the HLS_{19} core items, consisting of the 12 items measuring General HL and the 31 correlate items, needed to be answered to be accepted as a completed interview. Data collection was carried out in most of the participating countries by national data collection agencies and in three cases by the HLS_{19} National Study Centers. The following methods of data collection were used: paper-and-pencil personal interviews (PAPI) in DE and RU; computer-assisted personal interviews (CAPI) in SK; computer-assisted telephone interviews (CATI) in AT, HU, IE, NO, and PT; and computer-assisted web interviews (CAWI) in BE, CH (with a few CATI), DK, and FR. There were also mixed types of data collection, namely CAWI + CATI (by BG, CZ, IL, and IT) and CAPI + CAWI (by SI). Response rates varied considerably across methods of data collection, from 4% (FR using CAWI) to 94% (RU using PAPI). Due to the Covid-19 pandemic, the original timeframe for collecting data was extended, and the data collection phase lasted from November 2019 to June 2021. All participating countries ensured compliance with ethical guidelines and data protection and explicitly obtained informed consent from respondents before carrying out any interviews.

Due to the differences in methodology, the time of data collection, and the potential effects of Covid-19, differences in results between countries, and any comparison among them, must be interpreted with caution.

2.2 The HLS_{19} Instruments (Chapter 3)

To measure General HL, based on the HLS-EU instruments, an adapted 47-item instrument, the HLS_{19}-Q47, and two adapted short forms, the HLS_{19}-Q12 and the HLS_{19}-Q16, were developed to collect data. New instruments were developed to measure Digital HL, Communicative HL with physicians in healthcare, Navigational HL, Vaccination HL, and the Costs and Economics of HL, namely, respectively, the HLS_{19}-DIGI, the HLS_{19}-COM-P-Q11 (long form) and HLS_{19}-COM-P-Q6 (short form), the HLS_{19}-NAV, the HLS_{19}-VAC, and an item set to measure HL and health-related quality of life as a mediator for health costs. Additionally, 31 core correlates, and 18 optional correlates were also made available in the HLS_{19}. Participating countries had to implement at least the HLS_{19}-Q12 and the 31 core correlates; all other parts were optional. National add-ons were possible. The HLS_{19} instruments were translated into their national language(s) by 16 out of the 17 countries (Ireland used the original English version), thereby creating a rich spectrum of languages in which the instruments are now available: Arabic, Bulgarian, Czech, Danish, Dutch, French, German, Hebrew, Hungarian, Italian, Norwegian, Portuguese, Russian, Slovenian, and Slovak. Additionally, some countries translated the instruments into migrant languages. In 16 out of the 17 countries a field test was performed.

2.3 Methods of Data Analyses (Chapter 4)

Scores were calculated for the following HL measures:

HLS_{19}-Q12	General Health Literacy (12 items)
HL-DIGI	Digital Health Literacy (8 items)
HL-DIGI-INT	Digital Interaction Literacy (2 items)
HL-NAV	Navigational Health Literacy (12 items)
HL-COM-Q11	Communicative Health Literacy with physicians in health care services (11 items)
HL-COM-Q6	Communicative Health Literacy with physicians in health care services (6 items short form)
HL-VAC	Vaccination Health Literacy score (4 items, which were all taken from the HLS_{19}-Q47)

The score value was 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 individual items contained valid responses. Thus, the scores measure HL as the percentage of health-related tasks being experienced as “very easy” or “easy” by a respondent, with higher values indicating a higher level of General HL.

For General HL (HLS_{19}-Q12), each respondent was assigned to one of four levels of HL: excellent, sufficient, problematic, or inadequate.

For each measure, the Cronbach alpha coefficient was calculated and a confirmatory factor analysis with a single latent variable as well as a Rasch analysis were conducted to confirm the internal consistency and the unidimensionality of the scale. For some measures of specific HL, this was complemented by models for two latent variables, or rather two dimensions.

Associations (1) between HL and a pre-defined set of potential determinants of HL or (2) between potential consequences or outcomes of HL and associated determinants were estimated by means of Spearman correlation coefficients and multivariable linear regression models. The following variables were analyzed as potential determinants: gender, age, education, self-perceived level in society, financial deprivation/difficulties, migration background, long-term illnesses/health problems, and training in a health care profession.

3. Key Results for General Health Literacy

3.1 The Instrument of measuring General HL (Chapter 5)

For the concept and definition of comprehensive, general HL, the HLS_{19} followed the concept and definition of the HLS-EU, but instead of the long form Q47, the HLS_{19} used a specially developed HLS_{19}-Q12 shorter form to investigate General HL. (For those countries that used the Q47 or the Q22 data set for also constructing the Q16, data for the Q12 were extracted from this measure or data set.) The HLS_{19}-Q12 measure represents the HLS-EU matrix by using one indicator for each cell; the wording of its items was adapted slightly and its answer categories to “very easy”, “easy”, “difficult”, and “very difficult”.

3.1.1 Difficulty of Individual Items

To rank the individual items by difficulty, the response categories “very difficult” and “difficult” were combined. There were some common patterns for ranking the difficulties of HL-related tasks across countries, but there were also considerable differences between countries. The overall percentage of respondents ticking “very difficult” or “difficult” varied between 8% and 43% for the HLS_{19}-Q12 items. On average, the most difficult tasks were item 3 “to judge the advantages and disadvantages of different treatment options” (42%, varying from 26% to 71%), item 8 “to decide how you can protect yourself from illness using information from the mass media” (40%, varying from 26% to 62%), item 5 “to find information on how to handle mental health problems” (36%, varying from 19% to 50%), and item 12 “to make decisions to improve your health and well-being” (26%, varying from 12% to 42%).

3.1.2 Construction of Scores, Validation, and Psychometric Properties

The HLS_{19}-Q12 shows adequate internal consistency, with an average Cronbach alpha coefficient of 0.78 (varying from 0.67 to 0.87 for individual countries). With the twelve dichotomized HLS_{19}-Q12 items loading onto a single factor, the confirmatory factor model resulted in fit indices indicating a good model fit for each country. Three rather easy items differed considerably in relation to the standardized parameter estimates across countries. These were item 4 "to act on advice from your doctor or pharmacist" ("very difficult" or "difficult", 8% on average, ranging from 4% to 17%), item 9 "to find information on healthy lifestyles such as physical exercise, healthy food, or nutrition" (9.9% on average, ranging from 6% to 21%), and item 10 "to understand advice concerning your health from family or friends" (17% on average, ranging from 7% to 27%).

When testing data against the Partial Credit Model (PCM) by country, the HLS_{19}-Q12 displayed good overall data-model fit in eight participating countries. With a reduced sample size (n=360), the HLS_{19}-Q12 had acceptable overall data-model fit in an additional four participating countries. It had an acceptable reliability index in each country. The HLS_{19}-Q12 was somewhat "off target" as the items referred to tasks which most respondents in the participating survey studies perceived as manageable.

Using a principal component analysis of Rasch model residuals, two possible subscales or item subsets of the HLS_{19}-Q12 were identified empirically. However, these two subsets seem to measure "the same", and so it may be concluded that the HLS_{19}-Q12 is sufficiently unidimensional and measures one latent trait.

No evidence of response dependency or "too similar" items was observed. Most HLS_{19}-Q12 items displayed acceptable data-model fit. Several items displayed differential item functioning (DIF) even when the sample size was reduced to 1,080. This could affect comparisons of subpopulations across countries, age groups, or employment status.

In conclusion, the HLS_{19}-Q12 is a psychometrically rather sound instrument for measuring comprehensive General HL in adult populations as intended in the HLS_{19}.

The statistical representation of the HLS_{19}-Q47 by the HLS_{19}-Q12 was tested in six countries with a Pearson correlation of 0.93 (ranging from 0.90 to 0.95 for individual countries). Accordingly, the HLS_{19}-Q12 represents the total score of the HLS_{19}-Q47 very well from a statistical perspective.

3.1.3 Distributions of Scores and APRPs

The distribution of the scores was negatively (left) skewed for all countries. There was also a considerable ceiling effect, which partly indicates that the scale included tasks that many respondents found manageable. Thus, the instrument is sensitive especially for respondents with lower HL.

For all countries, the median score of the HLS_{19}-Q12 was 83, varying across countries from 67 to 91; the mean score was 76 and varied across countries from 65 to 86.

The ceiling effect and its variation across countries was also shown by the Average Percentage Response Patterns (APRPs) for HLS_{19}-Q12, where, on average, 24% answered the items as being either “very difficult” or “difficult” (varying from 14% to 35% between countries).

Based on defined cutting points, like those in the HLS-EU, categorical levels were constructed for the HLS_{19}-Q12. Accordingly, across all participating countries, about 40% of respondents had a “sufficient” level of HL, with about 15% being “excellent”. In contrast, about 33% had a “problematic” level and for 13% it was “inadequate”. There was considerable variation in level values across countries. Following the example of the HLS-EU study, the HL categorical levels of “inadequate” and “problematic” were combined and defined as “limited” HL, with a range of 25% to 72%. That means that between one in four and three out of four residents in countries participating in the HLS_{19} have limited General HL. Compared to the HLS-EU, with one out of three up to two out of three, the variation between countries is even more pronounced, which could be due to the different methodology used but also by different countries being included in the two studies.

3.1.4 Disadvantaged/Vulnerable Subpopulations

The HLS_{19}-Q12 mean score was considerably lower for selected predefined disadvantaged or vulnerable subpopulations than for the total population. This was, on average, especially true for respondents with “poor self-perceived health” (-14%, varying across countries from -5 to -27), respondents who are “financially deprived” (-8%, varying from +1 to -14), respondents reporting a “low self-perceived level in society” (-8%, varying from -2 to -18), or respondents with “low education” (-6% points, varying from +1 to -22).

3.3 Social Gradient and Determinants (Chapter 6)

To investigate the social gradient, indicators were used including gender, age, education, self-perceived level in society, and financial deprivation. The existence of a social gradient was confirmed by multivariable linear regression models explaining on average 7% of the variance of the HLS_{19}-Q12 score, ranging from 4% to 25% across countries. The strongest predictors of the social gradient were financial deprivation, with, on average, ß=-0.21 (varying from ß=-.15 to ß=-0.32 and significant ($p<0.01$ is referred to here and elsewhere in this summary) for all countries with one exception), followed by the respondents’ self-perceived level in society, with ß=0.10 (significant for 14 countries and varying for these from ß=0.08 to ß=0.26).

Models including additional predictors (respondents’ migration background, long-term illness, training in a health care profession) did not, on average, improve the explained variance of the models. In fact, respondents’ migration background had a significant effect on HL in just two countries (with migrants having a slightly higher level of General HL in those two countries), long-term illness in eight countries (respondents with at least one long-term illness having lower General HL), and training in a health profession in eight countries (respondents trained in a health profession having higher General HL).

Thus, the HLS_{19} confirms earlier results that there is a social gradient for General HL across countries which varies to a considerable extent and that both financial deprivation and level in society are the strongest predictors.

3.3 Consequences for Health-Related Outcome Indicators

3.3.1 Health Behaviors and Lifestyles (Chapter 7)

The potential effects of General HL on five indicators – BMI, smoking behavior, alcohol consumption, physical activity, and fruit and vegetable consumption – were investigated. Multivariable linear regression models showed significant effects of General HL on physical activity explaining, on average, 3% of the variance (varying across countries from 1% to 9%) with, on average, ß=0.11 (significant for 12 countries, varying for these from ß=0.08 to ß=0.27). Compared to the five social indicators, General HL is the strongest predictor of physical activity. For fruit and vegetable consumption, the same models explained 4% of the variance on average (varying from 4% to 9% across countries), with General HL being the second strongest predictor at ß=0.09 (significant for eight countries, varying for these from ß= 0.07 to ß=0.18). However, while similar models explained 5% of the variance for BMI, (varying from 1% to 14%), General HL was the predictor with the lowest ß on average, at ß=−0.01 (and was significant for only two countries at ß=−0.06). For smoking behavior, similar models explained, on average, 4% of the variance (varying from 1% to 14%); the results for General HL were significant, but inconsistently so, for only four countries, with either ß=−0.04 and ß=−0.06 or ß=+0.08 and ß=+0.09). For alcohol consumption, similar models explained 8% on average (varying from 5% to 16%), with General HL showing on average a low ß=−0.05, which was significant for only five countries: ß ranged from −0.05 to −0.13 in four countries but for the fifth ß=+0.09, which was in an unexpected direction.

Thus, according to the HLS_{19}, General HL was shown to have potentially positive effects on only two lifestyle indicators, namely physical activity and fruit and vegetable consumption. In contrast to some earlier research, no relevant and consistent effects on BMI, smoking behavior, and alcohol consumption could be demonstrated for most countries.

3.3.2 Health Status (Chapter 8)

The three Minimum European Health Module (MEHM) indicators (self-perceived health, long-term illness/health problems, and limited in activities due to long-term illness/health problems) were used to investigate the potential effects of General HL on respondents' health status. In all countries (equally weighted), a positive linear association was found between General HL and self-perceived health, while negative linear associations were demonstrated between General HL and long-term illness/health problems as well as between General HL and limited in activities due to long-term illness/health problems. These associations varied considerably in extent (and consistency) across participating countries.

In multivariable linear regression models for self-perceived health, including the five core social indicators and General HL as predictors, on average, 21% of the variance (varying from 11% to 38%), was explained, with General HL being the predictor with the third highest ß=−0.15 (varying from ß=-0.07 to ß=-0.22; significant for each country). Similar models for long-term illnesses/health problems explained 15% of the variance on average (varying across countries from 8% to 37%), with General HL again being the third highest predictor on average at ß=-0.09 (significant for seven countries, varying for these from ß=-0.06 to ß=-0.19 across countries). For being limited in activities due to health problems, the models explained, on average, 10% (varying from 3% to 22%), and General HL was the predictor with the second highest ß=0.14 on average, (significant for 13 countries, varying for these from ß=0.06 to ß=0.21).

Thus, this study confirmed earlier research that there is a potentially direct, relevant effect of General HL on respondents' health status. This pattern applied to most of the countries, with some variation in extent for the different health status indicators.

3.3.3 Extent of Healthcare Services Utilization (Chapter 9)

The potential effects of General HL on the extent of the utilization of healthcare services were investigated for five types of health services (emergency services, GPs/family doctors, medical or surgical specialists, inpatient hospital service, and day-patient hospital service).

Multivariable linear regression models, with General HL and five social indicators as predictors, explained just 2% of the variance on average (varying from 1% to 11%) for the utilization of emergency services, with General HL being the second highest predictor on average, at ß=-0.06 (significant for eight countries and varying for these from ß=-0.05 to ß=-0.20). Similar models for the utilization of GPs/family doctors explained, on average, 6% of the variance (varying from 4% to 14%), with General HL being the predictor with the second highest ß=-0.09 on average (significant for nine countries, varying for these from ß=-0.05 to ß=-0.14). For the utilization of medical and surgical specialists, similar models explained, on average, 3% of the variance (varying from 1% to 12%), with General HL being the predictor with the fourth highest significant ß=-0.05 on average (but significant for only four countries and varying for these from ß=-0.05 to ß=-0.10). Similar models for the utilization of inpatient hospital services explained, on average, just 2% of the variance (varying from 0% to 9% across countries), with General HL, on average, being the third highest predictor at ß=-0.04 (significant for just four countries and varying for these from ß=-0.05 to ß=-0.06). For the utilization of day patient hospital services, the models explained, on average, just 1% (varying from 1% to 4%), with General HL, on average, being the predictor with the second highest significant ß=-0.04 (significant for only two countries, varying from ß=-0.04 to ß=-0.06).

Thus, as expected from earlier research, a potentially direct, relevant effect of General HL on the utilization of health care services could be demonstrated just for specific indicators and for a smaller number of countries. While regression models did not explain much of the variance introduced by the classical social determinants included, in comparison to these, General HL was relatively relevant and is a better modifiable predictor of health care service utilization.

4. Specific Health Literacy Measures

In contrast to the HLS-EU study, in the HLS_{19}, besides measuring General HL, optional work packages were included for especially relevant specific aspects of HL, namely Navigational HL, Communicative HL with physicians, Digital HL, and Vaccination HL. These were developed and validated jointly, translated, and administered for the first time, with 12 countries participating in Digital HL, nine countries in Communicative HL with physicians in health care services, eight countries in Navigational HL, and 11 countries in Vaccination HL.

4.1 Navigational HL (Chapter 10)

4.1.1 Relevance

In the last few decades, the structures, and regulations of healthcare systems in many countries have become increasingly complex for patients and users and thus ever more difficult for them to navigate. Thus, more than ever before, specific Navigational HL is needed by patients and users alike. In response to a lack of measurement tools and population-based data on Navigational HL, one aim of the HLS_{19} was to develop and introduce a theory-based instrument for measuring Navigational HL and to provide data on the topic by the same instrument in a set of different countries for the first time.

4.1.2 Definition and Instrument

Using the conceptual framework of the HLS-EU Consortium and the HLS_{19} study, Navigational HL was defined as "people's knowledge, motivation and skills to access, understand, appraise and apply the information and communication in various forms necessary for navigating healthcare systems and services adequately to get the most suitable health care for oneself or related persons". An instrument for measuring Navigational HL was developed based on a scoping review of the literature, an expert and stakeholder survey, focus group discussions, personal interviews, and continuous discussions in the HLS_{19} Consortium. This led to a questionnaire with twelve items measuring self-perceived difficulties in accessing, understanding, appraising, and applying navigation-related information primarily for selected tasks on the macro (societal) and meso (organizational) levels of navigating health care services.

4.1.3 Data Collection

The Navigational HL was applied in eight countries (AT, BE, CH, CZ, DE, FR, PT, and SI) in seven languages in samples using CATI, CAWI, or mixed methods for data collection for a total of over 16,000 respondents.

4.1.4 Difficulty of Individual Items

The percentages of the combined "difficult" or "very difficult" answers to the 12 HLS_{19}-NAV items ranged from 19.5 % to 56.6 %, with considerable variation across countries. The most difficult tasks were dealing with information on health care reforms, the suitability of a particular health service, patients' rights, and health insurance coverage of specific health services.

4.1.5 Construction of Scores, Validation, and Psychometric Properties

A score for Navigational HL was calculated by combining the response categories "very easy" or "easy", adding these up over the twelve items, and standardizing the raw score for a range from 0 to 100. The scale proved to be a valid measure with acceptable psychometric properties concerning internal consistency (Cronbach's alpha between 0.83 and 0.92), and unidimensionality by CFA and polytomous partial credit Rasch models. Nevertheless, the instrument worked better in some countries than in others, and limitations exist regarding differential item functioning (DIF). With correlations on average between 0.40 and 0.56 with the other specific HLs and General HL, the instrument is related closely enough to be interpreted as being an instrument of HL and independent enough to measure a specific aspect of HL.

4.1.6 Distributions of Scores and APRPs

With, on average, a mean score of 55 (varying from 42 to 67), Navigational HL is low in most countries, at least compared to the measures of other health literacies. In terms of Average Percentage Response Patterns, 45% of the answers (varying from 33% to 59% across countries) were, on average, either "very difficult" or "difficult".

4.1.7 Disadvantaged/Vulnerable Subpopulations

In most countries, participants with poorer health (on average -12%), financial deprivation (-10%), and self-perceived level in society (-9%)) had mean scores for Navigational HL which were considerably below the population's average.

4.1.8 Social Gradient and Determinants

In multivariable linear regression models with five social determinants, explaining, on average, 6% of the variance (from 4% to 13% across countries), a social gradient was demonstrated for Navigational HL, with, on average, financial deprivation (ß=-0.15), self-perceived level in society (ß=0.14), and education (ß=-0.11) being the predictors with the highest ß values. When General HL was also introduced into the regression model, General HL was found to be the strongest predictor with, on average, ß=0.53.

4.1.9 Consequences for Health-Related Outcome Indicators

With similar regression models, higher HL-NAV was a significant predictor of <u>self-perceived health</u> with, on average, ß=-0.13 (significant in seven out of the eight countries and varying for these from ß=-0.06 to ß=-0.13). For <u>limited in activities due to health problems</u> this was the case, with, on average, ß=0.11 (significant for only five countries and varying for these from ß=0.07 to ß=0.10) and for <u>long-term illnesses or health problems</u>, with, on average, ß=-0.07 (significant for only two countries, with ß=-0.06 to ß=-0.10). For indicators of utilization of GPs/family doctors, and utilization of medical and surgical specialists, navigational HL was a significant indicator for only two or one countries.

4.1.10 Discussion and Conclusions

With the HLS_{19}-NAV, a new and extensively tested instrument with some potential for improvement is available, the implementation of which has provided important information for the specific field of managing health information in the context of navigating healthcare systems. The results confirm the need to strengthen Navigational HL (and General HL) through target group-specific, tailored strategies but also to reduce the demands placed on individuals by realizing health-literate healthcare systems and anchoring Navigational HL at all levels of the system.

4.2 Communicative HL with Physicians (Chapter 11)

4.2.1 Relevance

Communicative HL is recognized as being critical for patients to actively participate in health communication with health professionals, to obtain and understand information, to achieve successful outcomes from health care, and to use the information to manage health. Communication is a core task for health professionals and patients when making diagnosis, deciding on and implementing treatments, organizing appropriate health care, and maintaining good health. Communication in health care settings is becoming increasingly important due to changes in the patients' role, the expectation for more patient participation and for shared decision making. But for a start, the working group on this optional package developed an instrument just for Communicative HL with physicians.

4.2.2 Definition and Instrument

A comprehensive definition of Communicative HL is provided: "Communicative HL refers to patients' communicative and social skills that enable them to actively engage in face-to-face encounters with health care professionals, to give and seek information, derive meaning from it and apply this information in decision making and in co-producing their health care". However, the focus of this instrument is on physician-patient communication within the healthcare system. For this, a long form (11 items) and a short form (6 items) were constructed based on a comprehensive theoretical framework that integrates the communicative literacy concept of Nutbeam, the basic competencies of information processing included in the HL framework of the HLS-EU Consortium), and the main communicative tasks of the Calgary-Cambridge Guide framework.

4.2.3 Data Collection

The HLS_{19}-COM-P instrument was successfully applied in nine countries: Austria, Belgium, Bulgaria, Czech Republic, Germany, Denmark, France, Hungary, and Slovenia, in seven languages (in a total sample of around 20,000 for the HLS_{19}-COM-P-Q6) using different formats of data collection (PAPI, CATI, CAWI, or mixed methods).

4.2.4 Difficulty of Individual Items

Perceived difficulties ranged on average from 4% to 25% for the HLS_{19}-COM-P-Q11 items and from 9% to 26% for the HLS_{19}-COM-P-Q6 items. In general, getting enough time in the consultation with the physician and expressing personal views and preferences were experienced as being the most difficult tasks, while explaining personal health concerns was the easiest.

4.2.5 Construction of Scores, Validation, and Psychometric Properties

Scores for the long and short scales of Communicative HL were calculated by combining the response categories "very easy" and "easy", adding these up over the eleven or six items respectively, and standardizing the raw scores for a range from 0 to 100. Both instruments displayed acceptable psychometric properties for internal consistency with Cronbach's alpha (for HLS_{19}-COM-P-Q11: mean 0.83, from 0.79 to 0.87; for HLS_{19}-COM-P-Q6: mean 0.78, from 0.69 to 0.81), as well as for unidimensionality by CFA and polytomous partial credit Rasch models. Both instruments correlated moderately with General HL (mean 0.46 and 0.43 respectively) and with Navigational HL (mean 0.47 and 0.43 respectively), indicating that Communicative HL and General HL or Navigational HL are related but still distinctive constructs.

4.2.6 Distributions of Scores and APRPs

For all countries, the distributions of scores were rather left-skewed. Communicative HL with physicians, in the general population under investigation, was relatively good with a mean score for Q11 of 85 (ranging from 74 to 92) and a mean score for Q6 of 83 (from 72 to 90), but about 10-20% of the population have problems communicating with their physician. In terms of APRPs, 15% (from 8% to 26%) of the answers for the Q11 or 17% (from 9% to 27%) of the Q6 were either "very difficult" or "difficult".

4.2.7 Disadvantaged/Vulnerable Subpopulations

In most countries, participants with poorer self-perceived health (on average -11%) or lower socio-economic status (financial deprivation (-9%) and self-perceived level in society (-8%)) were found to have lower Communicative HL mean scores than their national population.

4.2.8 Social Gradient and Determinants

In multivariable linear regression models with five social determinants for the short form of Communicative HL, explaining on average 5% of the variance (varying across countries from 2% to 18%) a social gradient was identified for communicative HL, with, on average, level in society (ß=0.14), financial deprivation (ß=-0.13), and education (ß=-0.07) being the predictors with the highest ß values. When General HL was also introduced into the regression model, General HL was found to be the strongest predictor with, on average, ß=0.42.

4.2.9 Consequences for Health-Related Outcome Indicators

In most countries Communicative HL was a significant predictor of self-perceived health, while in some countries higher Communicative HL was associated with somewhat lower use of medical care.

4.2.10 Discussion and Conclusions

The HLS_{19}-COM-P instrument was used successfully in research on different national adult general populations to map communicative HL. Physician-patient communication is an important aspect of HL and a relevant issue for health policy and practice. It is of utmost importance for patient satisfaction and participation but also for health outcomes and health equity. The restriction of the study to physician-patient interaction indicates that further research is needed for Communicative HL focusing on other health professionals.

4.3 Digital HL (Chapter 12)

4.3.1 Relevance

The increasing availability and use of health-related digital/electronic resources such as electronic health records, telehealth initiatives, digital health applications, and interactive communication options with health care providers (e.g., for making appointments or reporting medical results) places a growing demand on the population's skills in relation to Digital Hl to adequately use these applications and resources. Researchers, practitioners, and policy makers should therefore realize the importance of understanding and improving people's proficiency in using digital resources for managing disease and/or promoting their health by measuring Digital HL.

4.3.2 Definition and Instrument

The concept and definition of Digital HL in the HLS_{19} is based on the HLS-EU Consortium's concept and definition of General HL but aligned with existing research on the scope and diversity of digital health resources. Digital HL includes the ability to search for, access, understand, appraise, validate, and apply online health information as well as the ability 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, and health related apps, etc. for promoting health. One scale was constructed with eight items measuring the skills related to dealing with health information digitally and two items for the interactive use of digital devices.

4.3.3 Data Collection

The following countries included the optional package on Digital HL in their national assessment: Austria, Belgium, Czech Republic, Denmark, France, Germany, Hungary, Ireland, Israel, Norway, Portugal, Slovakia, and Switzerland. Analyses were based on 29,060 respondents, with country specific sample sizes ranging from 1,000 to 3,602. There was variation in the data collection method administered, by using CAPI, CATI, CAWI, PAPI, and mixed formats.

4.3.4 Difficulty of Individual Items

The ranked difficulty of single tasks across countries is rather similar, with some exceptions. On average, the difficulty of items varies (for the combined response categories "very difficult or "difficult") between 22% and 54%, with considerable variation across countries. The three most difficult tasks were: "to judge whether the information is reliable", "to judge whether the information is offered with commercial interests", and "to use the information to help solve a health problem".

4.3.5 Construction of Scores, Validation, and Psychometric Properties

A score was calculated for Digital HL by combining the response categories "very easy" and "easy", adding them up across the eight items, and standardizing the raw score for a range from 0 to 100. The internal consistency of the Digital HL scale is acceptable with, on average, Cronbach's alpha of 0.83, varying across countries from 0.77 to 0.87. A single-factor confirmatory factor model with dichotomized items loading onto a single latent variable provided fit indices which indicate an acceptable fit for all countries. According to a principal component analysis (PCA) of Rasch model residuals combined with dependent t-tests to identify possible empirical subscales, the Digital HL scale was sufficiently unidimensional. The thresholds, and thus the response categories, were ordered and well-functioning. On average, Digital HL correlated with General HL (r=0.53), Navigational HL (r=0.55), Communicative HL (Q11: r=0.39, Q6: r=0.31), and Vaccination HL (r=0.38), and was thus related enough to the other HLs to measure HL and independent enough to measure a specific aspect of HL.

4.3.6 Distributions of Scores and APRPs

For all but one country, the distributions of Digital HL scores were left-skewed, with a clear ceiling effect. The mean score was, on average, 62, varying from 42 to 79 across countries. In terms of the APRPs, on average, 38% of the answers were either "very difficult" or "difficult", varying between 22% and 58% across countries.

4.3.7 Disadvantaged/Vulnerable Subpopulations

Disadvantaged or vulnerable subpopulations with lower mean scores of Digital HL than the national population were identified as respondents with bad or very bad self-perceived health (on average -11%), with considerable or severe financial deprivation (-9%), with low education (-8%), with six or more contacts to a GP/family doctor (-7%), and with low self-perceived level in society (-7%).

4.3.8 Social Gradient and Determinants

A social gradient for Digital HL was demonstrated by multivariable linear regression models with five social predictors; explained variance varied by country (6% on average, varying from 2% to

23%). On average, financial deprivation was the predictor with the highest ß=-0.15 (significant with ß between -0.08 and -0.27 for 10 countries), followed by age with ß=-0.13 (significant for six countries with ß between -0.15 and -0.26), self-perceived level in society with ß=0.08 (significant for 10 countries with ß between 0.05 and 0.13). Including the extent of use of digital resources in the model did not improve explained variance much, but the use of digital resources with, on average, ß=0.11 (significant for 10 countries with ß between 0.06 and 0.22) was the predictor with the third highest value, after financial deprivation and age. When General HL is also included in the original model, it is by far the strongest predictor of Digital HL with ß=0.51 (significant for all countries, varying from ß=0.43 to ß=0.67), followed by age (ß=-0.13), financial deprivation (ß=-0.06), and education (ß=0.06).

4.3.9 Consequences for Health-Related Outcome Indicators

In a multivariable linear regression model for explaining self-perceived health with the five social determinants and Digital HL as predictors, Digital HL was significant for nine out of 13 countries (with ß=-0.05 or -0.10). A similar model for the utilization of GPs/family doctors as dependent variable showed significant effects of Digital HL for seven countries (ß between -0.07 and -0.11).

4.3.10 Discussion and Conclusions

A new, short eight-item scale for measuring experience-based Digital HL was jointly developed, validated, and used for investigating Digital HL in thirteen countries. The measure showed acceptable psychometric properties for all countries, but further development is recommended. The results demonstrated the relevance of Digital HL by revealing that a considerable proportion of respondents have lower Digital HL, that there is a social gradient for Digital HL in most countries, and that Digital HL is associated with the health-relevant indicators self-perceived health also in most countries and with utilization of GPs/family doctors in some countries. By identifying especially difficult, concrete tasks relating to Digital HL and subpopulations with lower Digital HL than the national adult population, the results offer an orientation for tailoring strategies to improve Digital HL by health policy.

4.4 Vaccination HL (Chapter 13)

4.4.1 Relevance

Vaccine hesitancy is a pressing public health issue, especially in Europe, and it poses an increasing challenge to health authorities. Credible and tailored information about vaccination could help regain individuals' confidence in vaccinations. However, as information on vaccination is often difficult to access, complex, not always easy to understand, and challenged by biased and one-sided information, a high level of Vaccination HL is a prerequisite for assessing the trustworthiness and quality of information and for dealing competently with false and misleading information.

4.4.2 Definition and Instrument

Based on the definition of General HL the working group defined Vaccination HL as referring to people's knowledge, motivation, and skills to find, understand, and evaluate immunization-related information to make informed decisions on immunization. A context-independent measure of Vaccination HL was developed, measuring the process dimensions of finding, understanding, judging, and applying vaccination information for better immunization, based on a partial adaptation of the four vaccination-related items included in the HLS-EU survey. In addition, the optional package on HL-VAC also included one item on personal vaccination behavior during the last five-year period, four items referring to personal confidence in vaccinations (Confidence), three items on myths about possible risks of getting vaccinated (Calculation/Conspiracy), and one item on the risk of getting a disease for which a vaccine exists if not vaccinated (Complacency).

4.4.3 Data Collection

Seven countries (AT, BE, CZ, HU, IE, PT, SI) implemented the complete optional package on Vaccination HL, and four additional countries (BG, DE, IT, and NO) collected data on at least the four HL-VAC items and general background variables. Differing by country, data were collected by PAPI, CAPI, CATI, and CAWI, or combinations of these. In total, data on Vaccination HL are available for just over 25,000 respondents in Europe.

4.4.4 Difficulty of Individual Items

There was a rather common ranking of difficulty of the four items across countries, with "judging which vaccinations you or your family needs" as the most difficult item, followed by "finding information on recommended vaccinations", "deciding if you should have a flu vaccination", and "understanding why you or your family may need vaccinations".

4.4.5 Construction of scores, Validation, and Psychometric Properties

A score was calculated for Vaccination HL by combining the response categories "very easy" and "easy", adding these up over the four items, and standardizing the raw score for a range from 0 to 100. The internal consistency of the Vaccination HL scale with an, on average, Cronbach's alpha of 0.72, varied between 0.60 and 0.85, indicating that the reliability of the scale is acceptable for most countries. Confirmatory factor and discriminant analyses revealed that the HL-VAC measures a different but related trait or competencies than the overall HL scale (HLS_{19}-Q12). The overall data-model fit to the Rasch model was sufficient for the Vaccination HL scale for five countries, acceptable for four countries, but poor for two countries. The scale did not measure invariantly across countries since the "difficulty order" of the items varied between countries.

4.4.6 Distributions of Scores and APRPs

The distribution of the Vaccination HL score was negatively skewed across all countries, suggesting a ceiling effect. The mean score for all countries (equally weighted) was 75, varying from 58 to 87. In terms of APRPs, on average 25% of the responses rated the Vaccination HL items as either "very difficult" or "difficult", varying between countries from 13% to 45%.

4.4.7 Disadvantaged/Vulnerable Subpopulations

Respondents with low education (in six countries), low self-perceived level in society in ten countries), some or severe financial deprivation in all 11 countries), and limited by health problems (in eight countries) had lower Vaccination HL mean scores compared to the corresponding comparison groups.

4.4.8 Social Gradient and Determinants

In multivariable linear regression models with five potential social determinants, there is a weak social gradient for Vaccination HL, with financial deprivation being the predictor with the highest ß=-0.17 on average (significant for all but one countries), followed by level in society (ß=0.05, significant for three countries), and education (ß=-0.04, significant for five countries). In a model with General HL added, General HL is by far the predictor with the highest ß=0.51 (varying across countries from ß=0.39 to ß=0.70).

4.4.9 Consequences for Health-Related Outcome Indicators

In all but one country, Vaccination HL is positively correlated with confidence in vaccinations, knowledge about the risks of vaccines, and risk assessment of developing a specific disease if not vaccinated. Vaccination behavior, defined as the odds of someone in the family being vaccinated in the last five years, increased as a function of Vaccination HL for five out of seven countries, when controlling for socio-demographic and socio-economic variables, and being trained in a health profession. Mediation analysis using the Baron and Kenny approach showed that the relationship between Vaccination HL and vaccination behavior is at least partly mediated by confidence in vaccinations, risk knowledge, and risk perception.

4.4.10 Discussion and Conclusions

As such, the measure is suitable for measuring Vaccination HL in different countries but could be further developed with a focus on additional, specific HL-VAC tasks. The results demonstrated the relevance of Vaccination HL by revealing that a considerable proportion of respondents have lower Vaccination HL, that there is a social gradient for Vaccination HL in most countries, and that Vaccination HL is associated with vaccination behavior in most countries.

4.5 Health literacy and health-related quality of life as a mediator for health costs (Chapter 14)

4.5.1 Relevance

The objectives/research questions of this chapter were twofold: first to explore whether there is a relationship between general, comprehensive HL (as measured by HLS_{19}-Q12), and health-related quality of life (as measured by EQ-5D-5L), and secondly to explore the relationship between HL and work absenteeism.

Both health-related quality of life and absenteeism have cost and economic implications for health services, for individuals and for society. Such costs are in the context of rising health care expenditure and limited health budgets globally. The findings provide evidence to inform policy makers of the importance of interventions to enhance HL as a disease prevention strategy so as to improve health-related quality of life and reduce the incidence of absenteeism amongst citizens. Such outcomes will assist in more efficient use of scarce resources for health care expenditure, a better quality of life for citizens, with consequent implications for society.

4.5.2 Specific Instruments and Indicators

Health Related Quality of life (HRQoL) denotes the impact of health on a person's ability to live a fulfilling life, defined by the World Health Organisation (WHO) as an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns. HRQoL thus represents a broad concept of physical, psychological, and social functioning and well-being including both positive and negative aspects.

Absence from work was measured by the number of days of absenteeism per year due to health problems

4.5.3 Data Collection

Specific data for this chapter was collected for the measure EQ-5D-5L in three countries Denmark, Ireland, and Norway. Differing by country, data were collected by CATI (Ireland and Norway) and CAWI (Denmark). In total data on EQ-5D-5L are available for nearly 6,000 respondents in the three countries.

4.5.4 Method

A freely available English syntax file for transforming the responses to the EQ-5D-5L questionnaires into an EQ-5D-5L estimate for individual respondents was used. For regression analyses with EQ-5D-5L as the dependent outcome variable, it was relied on Ordinary Least Squares (OLS) estimation with "robust" estimates of variance to account for violations of homoscedasticity.

The analysis of number of days of absenteeism per year due to health problems was based on the two-step model ("Two-part model") where the first step is based on "probit" and the second step on General Linear Modelling (GLM) with gamma "distribution family", log link function and "robust" estimation of variance.

4.5.5 Results

Research Question 1

The analysis of Health-Related Quality of Life (HRQoL), as measured by EQ-5D-5L, in the three countries Denmark, Ireland and Norway, shows a significant association between General HL and health related quality of life. In general, as HL increases so does HRQoL.

The magnitude of the association between General HL and HRQoL is larger than that for the association between education and HRQoL highlighting the importance of HL interventions to improve General HL levels for adult populations. The associations observed between HRQoL and General HL and other social determinants of health appears to be additive for education level, gender and employment status.

Research Question 2

For both Norway and Denmark, a negative correlation between HL and absenteeism was observed. As General HL increases there is a decrease in absenteeism from work due to health problems. For Ireland when General HL score increases from 0 to about 70, absenteeism increases, however absenteeism decreases thereafter, noting that 73% of the respondents have a General HL score between 70% – 100%. These findings suggest that further research and analysis of the HLS_{19} international data is required to fully understand the complexities surrounding the correlation between HL and absenteeism from the workplace.

4.5.6 Discussion/Conclusion/Recommendations

This is the first European study to explore and measure the relationship between General HL (as measured by HLS_{19}-Q12), and health-related quality of life (as measured by EQ-5D-5L) which have consequential cost and economic implications for the health services, for individuals and for society. The sample size within this study was large across the three countries where the health-related quality of life data were collected for EQ-5D-5L. Unlike prior studies of the health economic implications of HL all the data were directly measured, with no data inferred.

The findings of the HLS_{19} study are sufficiently strong for national and local governments to recognise the importance of General HL for the health and well-being of their citizens and in the utilization of health services. Investment in HL interventions as a disease prevention strategy at local, national and regional levels may lead to significant benefits to citizens for their quality of life alongside more effective use of expensive health services.

5. Recommendations

One of the aims of the HLS_{19} was to gather evidence to inform policy, practice, and further research. The data allow to distinguish aspects and domains of HL that need more attention than others. The same holds true for different population groups, identifying those at the lower end of the social gradient who are in more need of support in relation to their HL. The data, however, do not provide evidence for specific concrete interventions to address the areas that need to be improved.

On these grounds, the HLS_{19} consortium agreed on a set of recommendations, presented here in a shortened format.

Regarding General HL

- Health policy should include an investment in longitudinal studies, measuring and monitoring population HL regularly, and should systematically implement interventions to improve HL.
- Interventions should be specifically targeted at at-risk groups for low HL to reduce the health gap between groups.
- Interventions to improve HL should focus on all four aspects of processing health-related information (accessing, understanding, appraising, and applying information) within the domains of healthcare, disease prevention, and health promotion.
- For interventions related to specific, concrete HL tasks, the tasks that are experienced as being more difficult should be prioritized.
- The quality of health information in the mass media should be improved.
- Interventions to improve HL in relation to mental health should be prioritized and supported by specific research.

Regarding specific HLs

- Health policy should develop strategies to improve people's Navigational HL, specifically interventions on systemic and organizational levels to make health systems more health-literate, user-friendly, and easier to navigate.
- Interventions to improve the communication of health professionals with patients should have high priority. Specifically, support for health professionals, especially physicians, in dedicating more time to person-centered communication is needed.
- Regarding Digital HL, emphasis on providing easily accessible, high quality, trustworthy, understandable, assessable, and applicable health information, as well as communication via digital sources should be increased.
- Improving Vaccination HL should have top priority, with a focus on judging vaccination information by improving the trustworthiness of information and communication on vaccinations.

Regarding research on HL

» The HL of the adult resident population should be measured regularly in as many countries as possible.
» The next wave of measuring should be planned for data collection in 2024.
» In preparation for this next wave, more specific research should be funded to analyze existing data in more depth as well as to revise, extend, and apply the tools for measuring HL and relevant correlates.
» For the four specific HLs, more detailed analyses and publications on the HLS_{19} data are needed as well as further research and development on improvements for later applications.
» Additionally, further specific health literacies or relevant topics of General HL should be reviewed, selected, and researched to be included in the next wave of measuring HLs.
» More detailed analyses are needed regarding the costs and economics of HL.
» Further dissemination of the results of the HLS_{19} through peer-reviewed scientific publications is required.

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Abbreviations

General abbreviations

APRP	Average percentage response patterns
BMI	Body mass index
DIF	Differential item functioning
EHIS	European Health Interview Survey
ESS	European Social Survey
EU-SILC	The European Union Statistics on Income and Living Conditions
HL	Health literacy
HLS_{19}	The International Health Literacy Population Survey 2019-2021 of M-POHL
ICC	International Coordination Center
GÖG	Austrian National Public Health Institute
NSC	National Study Center
M-POHL	Action Network on Measuring Population and Organizational Health Literacy
n.a.	Not applicable
OP	Optional package
PI	Principal investigator
PR	Policy representative

Country codes

AT	Austria
BE	Belgium
BG	Bulgaria
CH	Switzerland
CZ	Czech Republic
DE	Germany
DK	Denmark
EL	Greece
ES	Spain
FR	France
HU	Hungary
IE	Ireland
IL	Israel
IT	Italy
NL	The Netherlands
NO	Norway
PL	Poland
PT	Portugal
RU	Russia
SK	Slovakia
SI	Slovenia

Methods of data collection

CAPI	Computer-assisted personal interviews
CATI	Computer-assisted telephone interviews
CAWI	Computer-assisted web interviews
PAPI	Paper-and-pencil interviews

Health literacy measures mainly used in tables and figures

GEN-HL	General Health Literacy score
HL-DIGI	Digital Health Literacy score
HL-DIGI-INT	Digital Interaction Literacy score
HL-NAV	Navigational Health Literacy score
HL-COM-Q6	Health literacy relating to communication with physicians in health care services score (6 items)
HL-COM-Q11	Health literacy relating to communication with physicians in health care services score (11 items)
HL-VAC	Vaccination Health Literacy score

HL tools

HLS_{19}-Q47	The generic English instrument for measuring health literacy in the general population, 47 items
HLS_{19}-Q16	The generic English instrument for measuring health literacy in the general population, 16 items
HLS_{19}-Q12	The generic English instrument for measuring health literacy in the general population, 12 items
HLS_{19}-COM-P-Q6	The English HLS_{19} instrument for measuring health literacy relating to communication with physicians in health care services in the general population, six items
HLS_{19}-COM-P-Q11	The English HLS_{19} instrument for measuring health literacy relating to communication with physicians in health care services in the general population, 11 items
HLS_{19}-DIGI	The English HLS_{19} instrument for measuring Digital Health Literacy in the general population
HLS_{19}-ECON	The English HLS_{19} instrument for measuring the cost and health economics of health literacy in the general population
HLS_{19}-NAV	The English HLS_{19} instrument for measuring Navigational Health Literacy in the general population
HLS_{19}-VAC	The English HLS_{19} instrument for measuring Vaccination Health Literacy in the general population
NVS	Newest Vital Sign Test

1 Background of the HLS19

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1.1 The relevance of measuring health literacy in health care & public health (before the HLS-EU)

The measurement of health literacy (HL) started in the US and mostly involved assessing patients' HL using different (short) tests of functional HL (e.g., TOFHLA, REALM, NVS) (Rudd 2017). It was soon observed that low HL had detrimental health outcomes (DeWalt et al. 2004; Nielsen-Bohlman et al. 2004; Parker 2000). Later, a few studies used the functional HL tests on general populations. In 2003, the National Assessment of Adult Literacy (NAAL) (Kutner et al. 2006), included a specific section on measuring HL for the first time. The HL section focused on the ability to read, understand, and apply health-related information in English and focused on health tasks that were grouped into categories relating to clinical and preventive contexts as well as navigation of the health system. Concerning general populations and for matters of public health, a broader understanding of HL is preferable, as are more comprehensive instruments for measurement. This was pursued by researchers, who aggregated items relating to health issues from the available pre-2003 general large-scale adult literacy tests and constructed the Health Activities Literacy Study (HALS), which contained 191 health-related items and represented a comprehensive measurement instrument (Rudd et al. 2007). HALS included health activities in five dimensions: health promotion, health protection, disease prevention, health care and maintenance, and health care systems navigation. Although HALS was utilized in the first decade of this century on samples in the US (data collection 2003, (Rudd 2007; Rudd et al. 2004)), Canada (data collection 2003, (Murray et al. 2008), and in a few European countries (data collection 2003 in Italy, Norway, and Switzerland (Notter et al. 2006)), it was not administered again.

In Europe, the measurement of HL in general populations began when Ilona Kickbusch and Don Nutbeam recognized the potential of HL for health promotion and public health, in addition to its importance for clinical healthcare (Kickbusch 2002; Kickbusch/Maag 2008; Kickbusch 2001; Kickbusch et al. 2006; Nutbeam 2000; Nutbeam 2008; Nutbeam/Kickbusch 2000). After 2004, Kickbusch advocated for HL at the European Health Forum Gastein (Kickbusch 2004) and was successful in initiating a HL population survey (the HLS-CH) in Switzerland in 2006 (Wang/Schmid 2007; Wang et al. 2014). The HLS-CH did not use HALS since participant interviews took a significant amount of time and were not suitable for telephone interviews (CATI). Instead, a new, mainly self-reporting instrument was developed which was rather comprehensive and yet still took less time (about 30 minutes in a telephone interview). The HLS-CH was a multidimensional instrument that contained 127 questions on 30 competences with various response formats that measured participant knowledge, behaviors/skills, motivation, and attitudes. As a result, the HLS-CH provided a profile for different dimensions of HL rather than one general measure for HL (as provided by HALS). The approach underlying the HLS-CH for measuring HL was "closer to the public health asset model than the clinical risk factor one" (Wang et al. 2014). As mentioned above, this perception-based instrument was first applied using CATI in a randomly selected sample of n=1,250 respondents from the resident population aged 15 and above in Switzerland in 2006.

Between the proponents of 'objective' performance-based tests and those of 'subjective' perception-based instruments, a debate persists as to how best measure HL. Most of the existing tests, except for HALS, measured – and still measure – a narrow understanding of functional health literary and not HL's interactive and critical aspects (Nutbeam 2000). Of course, it can be argued that a test instrument is preferable if decisions about the individual participants are based on the results of their assessments. To measure population HL for public health, however, it is more important to assess a comprehensive concept of HL, which is accomplished more efficiently by using a self-reporting perception-based instrument.

The results of the HLS-CH also stimulated a public and political debate in Switzerland regarding health policy. This suggested that HL was more acceptable as a bona fide public health issue once evidence-based data on distributions of and associations with HL became available within the general population, as was the case earlier in the US, as well as in Canada, and Australia. The experiences of measuring population HL in Switzerland (and the health policy debate that the HLS-CH study triggered off) stimulated interest in measuring population HL in some of the European Union's member states. While representatives of the European Commission became convinced of the relevance of investing in an assessment of population HL in 2006, it took three years until a research consortium was established and a research proposal was developed, accepted, and supported by the Executive Agency for Health and Consumers (EAHC) of the European Union (EU). So, work on a new, international study, called the HLS-EU, began in 2009.

1.2 Policy recommendations concerning HL by the WHO and other international and national stakeholders

In the WHO's Ottawa Charter (1986), HL was not mentioned but, as one of its Health Promotion Action strategies, "Develop personal skills" was introduced, with the following explanation: "Health promotion supports personal and social development through providing information, education for health and enhancing life skills. By so doing, it increases the options available to people to exercise more control over their own health and over their environments, and to make choices conducive to health. Enabling people to learn throughout life, to prepare themselves for all of its stages and to cope with chronic illness and injuries is essential. This has to be facilitated in school, home, work and community settings. Action is required through educational, professional, commercial and voluntary bodies, and within the institutions themselves." In the WHO's Health Promotion Glossary (WHO 1998) a definition of HL was included as: "The cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health" (Nutbeam 1998). This was followed by the WHO's publication *Health Literacy: The solid facts* (Kickbusch et al. 2013; Kickbusch et al. 2016), which partly built on the concepts and results of the HLS-EU study (2012) and collected evidence on the measurement of and interventions in HL in different settings. It also recommended measuring population and organizational HL in Europe on a regular basis.

HL was also a topic at several of the WHO's Global Conferences on Health Promotion and will be included in the program of the WHO's 10th Global Health Promotion Conference and was highlighted in documents related to these conferences, e.g., The Nairobi Call to Action for Closing the Implementation Gap in Health Promotion (2009), or the Shanghai Declaration on promoting health in the 2030 Agenda for Sustainable Development (2016). It was also mentioned in documents like the Bangkok Charter for Health Promotion in a Globalized World (2005), the Mexico City Political Declaration on Universal Health Coverage (2012), the Helsinki Statement on Health in All Policies (2013), the Montevideo Roadmap 2018-2030 on NCDs as Sustainable Development Priority (2017), the Declaration of Astana (2018), and the resolution "Towards the implementation of HL initiatives through the life course" (2019) (EUR/RC69/R9) which demands, among others, the promotion of HL with a focus on reducing health inequities and the strengthening of HL measurements and action. Also, two of the WHO's HEN reports were dedicated to HL (Rowlands et al. 2018; WHO Regional Office for Europe 2019).

While the concept of 'health literacy' was originally used in the United States and Canada; it was later used internationally not only in connection with health care but also in the context of public health (Pleasant/Kuruvilla 2008), also in Europe. HL was explicitly mentioned as an area of priority action in the European Commission's Health Strategy 2008-2013 (European Commission 2007). It was linked to the core value of citizen empowerment, and the priority actions proposed by the European Commission included the promotion of HL programs for different age groups. HL has since gained momentum on the European health agenda. Closely linked to empowerment, it can be defined as 'the ability of citizens to make sound decisions concerning health in daily life – at home, at work, in health care, at the marketplace, and in the political arena' (Kickbusch/Maag 2008). This is exemplified by the inclusion of HL in European policy documents such as in the European Commission's White Paper entitled 'Together for Health' (European Commission 2007), the Health 2020 strategy of the (WHO 2013) WHO European Region (2012). the Vilnius Declaration on Sustainable Health Systems for Inclusive Growth in Europe, agreed to by health ministers during the Lithuanian Presidency of the European Union (The Lithuanian Presidency of the Council of the European Union 2013).

Besides these international initiatives, from early on, national programs and action plans, etc. were initiated to take better account of HL in health care and public health and to strengthen it with the help of specific measures. Stimulated by measuring HL, action plans were published for Canada (Public Health Association of British Columbia 2012; Rootman/Gordon-El-Bihbety 2008), the US (U.S. Department of Health and Human Services 2010), Australia (Australian Bureau of Statistics 2008); (Australian Commission on Safety and Quality in Health Care 2014), and New Zealand (Ministry of Health 2010; Ministry of Health 2015).

Some countries in Europe also issued policy documents for improving HL, e.g., Wales (Puntoni 2010), Ireland (National Adult Literacy Agency/O'Connor 2012), Scotland (Scottish Government

2014). England (Public Health England 2015), and Portugal (Grupo de Trabalho do Plano Nacional de Saúde 2013). Thanks to the HLS-EU, at least two countries introduced sustainable policy initiatives, Austria (Federal Ministry of Health and Women's Affairs 2012), and Germany (Schaeffer et al. 2020; Schaeffer et al. 2018). Several countries also initiated alliances or coordination platforms (e.g., Austria, Germany, Switzerland) or prizes for excellent HL practice and research (e.g., Ireland, Netherlands, Switzerland), and in many countries official websites related to HL were established.

Later, already within the context of M-POHL, a few countries already initiated policies and strategies to improve HL, e.g., the Czech Republic (integration of HL into the Health 2020 Roadmap, founding a National HL Institute), and Norway (Ministry of Health and Care Services 2019). Concerning national policy initiatives for promoting HL, Adriaenssens et al. (2021) provide an analysis on lessons to be learned based on six countries (Australia, Austria, Ireland, the Netherlands, Portugal, and Scotland) for developments of HL policy plans, implementation of these, their content, opportunities and threats, and evaluation of the HL policies and plans.

1.3 The original HLS-EU study and its follow-up studies

This section is mainly based on the following publications: Pelikan/Ganahl (2017); Pelikan et al. (2019); Pelikan et al. (2020a); Pelikan (2020b).

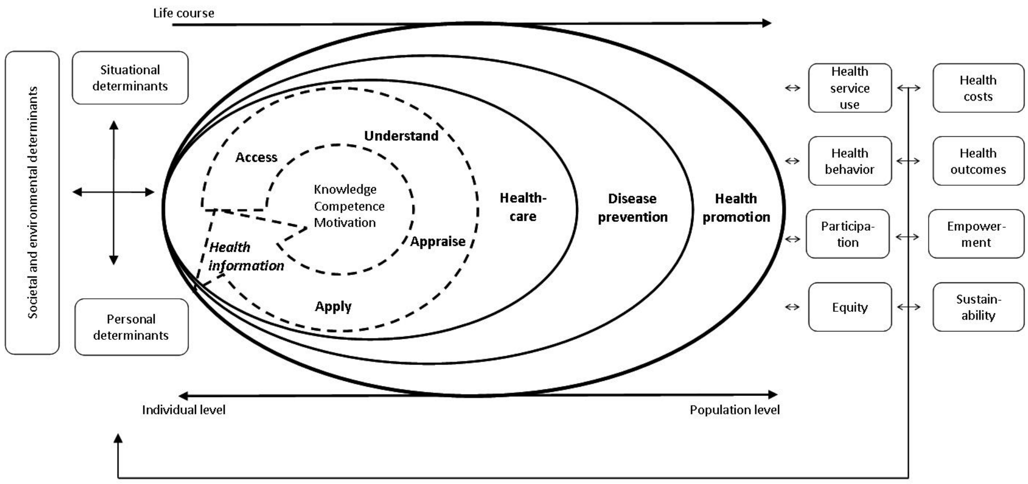
1.3.1 Concept and definition of Health Literacy

While studies had demonstrated the prevalence of limited HL in the US and across the world (for an overview see Pleasant (2013)), population data on HL levels in the European Union (EU) were unavailable. Therefore, starting in 2004, some researchers spent several years trying to initiate an international comparative survey (Pelikan et al. 2019), which finally resulted in a grant agreement with the European Agency for Health and Consumers in 2008 (HLS-EU Consortium 2008). The HLS-EU Project was then co-financed by the European Commission's Health Programme (Grant no. 2007-113) and the national organizations taking part in the project. Due to limited founding, a consortium of nine organizations from only eight EU member states (Austria, Bulgaria, Germany, Greece, Ireland, the Netherlands, Poland, and Spain) launched the European Health Literacy Project (HLS-EU) to conduct the first comparative European HL survey.

Notable aims of the project included developing a model instrument for measuring HL and generating first-time data on HL across diverse populations in the EU. This would then facilitate a comparative assessment and provide an empirical basis for European, national, and regional health policies.

A systematic literature review of 17 existing explicit HL definitions and 12 conceptual models resulted in an integrated definition of the comprehensive concept of HL: "Health literacy is linked to literacy and encompasses people's knowledge, motivation and competencies to access, understand, appraise and apply information to form judgments and take decisions in terms of healthcare, disease prevention and health promotion to improve quality of life during the life course" (Sørensen et al. 2012).

Figure 1.1: The HLS-EU Conceptual Model of Health Literacy



Source: (Sørensen et al. 2012)

In addition, a conceptual and generic model (Figure 1.1) was developed that captures the most comprehensive evidence-based dimensions of HL with its main antecedents and consequences. In the definition and the model, health promotion is understood in the broad sense defined by the World Health Organization in the Ottawa Charter ((WHO Regional Office for Europe 1986). This conceptual model and the related definition are more comprehensive than most of their forerunners since they follow a broader understanding of "literacy" as well as of "health".

This model and definition of HL served as a basis for developing a multidimensional conceptual matrix to operationalize a questionnaire aimed at measuring comprehensive HL in general populations. It was named the HLS-EU-Q47 and was developed in eight steps (item generation, focus groups, pre-testing, expert consultation, finalization of the questionnaire, plain language check, translation, field test) (Sørensen et al. 2013).

Table 1.1:
Matrix of subdimensions of HL based on the HLS-EU Conceptual Model (Sørensen et al. 2012) used for developing the HLS_{19} instruments

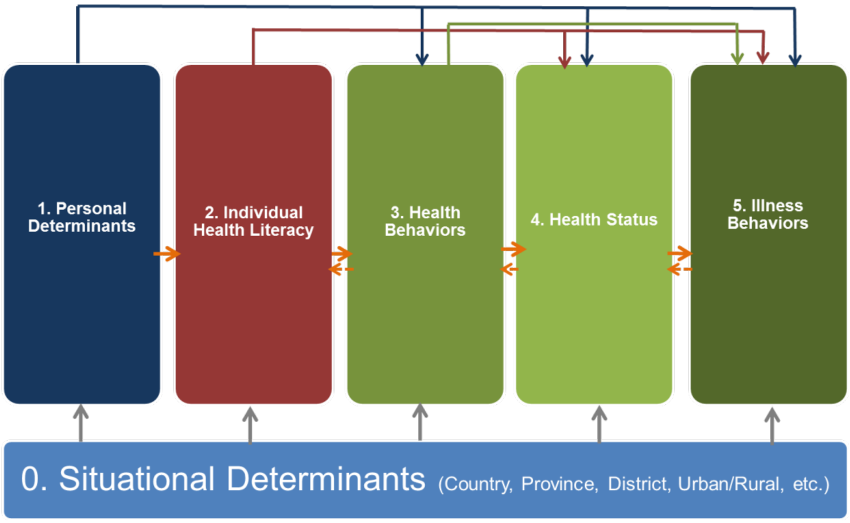
Health Literacy	Access/obtain information relevant for health	Understand information relevant for health	Appraise/judge/evaluate information relevant for health	Apply/use information relevant for health
Health Care	1) Ability to access information on medical or clinical issues	2) Ability to understand medical information and derive meaning	3) Ability to interpret and evaluate medical information	4) Ability to make informed decisions on medical issues
Disease Prevention	5) Ability to access information on risk factors	6) Ability to understand information on risk factors and derive meaning	7) Ability to interpret and evaluate information on risk factors	8) Ability to judge the relevance of information on risk factors
Health Promotion	9) Ability to update oneself on health issues	10) Ability to understand health-related information and derive meaning	11) Ability to interpret and evaluate information on health-related issues	12) Ability to form a reflected opinion on health issues

Source: Sørensen et al. (2012)

This model distinguishes between four aspects of health-related information management or four cognitive dimensions: to access/obtain, understand, appraise/judge/evaluate, and apply/use information relevant for health. For each of the four aspects, three domains are considered in which dealing with health-relevant information is necessary: healthcare (or managing illness), disease prevention, and health promotion (Table 1.1).

» The *domain of healthcare* is where HL refers to the ability to access information on medical or clinical issues, to understand medical information and derive meaning, to interpret and evaluate medical information, and to make informed decisions on medical issues as well as comply with medical advice.
» The *domain of disease prevention* is where HL involves the ability to access information on risk factors for health, to understand information on risk factors and derive meaning, to interpret and evaluate information on risk factors, and to make informed decisions to protecting against risk factors for health.
» The *domain of health promotion* is where HL refers to the ability to regularly update oneself on determinants of health in the social and physical environment, to understand health-related information and derive meaning, to interpret and evaluate information on determinants of health in the social and physical environment, and to make informed decisions on health determinants in the social and physical environment, and also engage in joint action.

Figure 1.2:
The Vienna Model of Health Literacy defining the principal determinants and consequences of HL



Source: HLS-Consortium

To analyze associations of HL with relevant correlates, determinants, or consequences of HL, the Vienna HLS-EU team specified the original generic/logical model in more detail (Figure 1.2). The Vienna Model distinguishes between personal and situational factors influencing personal HL as well as between direct and indirect effects of HL on an individual's health-relevant behaviors, health status, and illness behaviors. A main direction for causality is proposed as well as the possibility of reciprocal or cyclical causality (Pelikan/Ganahl 2017a).

According to the Vienna Model (see Figure 1.2), individual or personal HL (2.) is influenced by personal determinants (1.) like socio-demographic and socio-economic factors (such as gender, age, educational level, migration status) on the one hand and situational determinants on the other hand. Personal HL, in turn, can directly influence lifestyle-related health behaviors (3.) like tobacco and alcohol consumption, physical activity, and nutrition. Personal HL can have a direct and indirect influence on indicators of health status (4.) like self-perceived health and long-term illnesses/health problems. Long-term illnesses/health problems could also be considered a personal determinant of HL. Next, illness behaviors (5.) like the extent of utilization of health care services can be directly influenced by HL, and indirectly by its effects on health behaviors and health status. Furthermore, health behaviors, health status, and illness behaviors can also be influenced by personal and situational determinants. The model also includes (albeit smaller) causal or cyclical effects in the opposite direction.

1.3.2 Methods

The European Health Literacy Survey (HLS-EU, 2009-2012) was conducted during the summer of 2011 across eight European countries (Austria, Bulgaria, Germany (North Rhine-Westphalia), Greece, Ireland, Netherlands, Poland, and Spain). In each country, a random sample of approximately 1,000 EU citizens, 15 years and older, was interviewed, yielding a total sample of approximately 8,000 respondents. On behalf of the HLS-EU consortium, TNS Opinion collected the data, applying Eurobarometer standards in methodology and sampling procedures, i.e., for EU citizens only, not for residents with other nationalities living in these countries. Data were collected face to face via a standardized questionnaire using a Computer Assisted Personal Interviewing (CAPI) mode in all countries except for Bulgaria and Ireland, where a Paper Assisted Personal Interview (PAPI) was used. To measure HL, the 47 items of the instrument labelled HLS-EU-Q47 were assessed using a 4-point self-report scale (very easy, easy, difficult, very difficult) to measure the perceived difficulty of selected health-relevant tasks. Therefore, the HLS-EU-Q47 measures self-perceived HL and reflects the fit between individual competences and situational complexities or demands. This must be borne in mind when interpreting the survey results, and especially when comparing these results across the participating countries.

Based on the 47 items, a general index and seven sub-indices were constructed (healthcare, disease prevention, and health promotion as well as finding, understanding, appraising, and using health-related information) as well as sub-sub-indices for the 12 cells of the conceptual matrix. Indices represent the sum of the values for the answer categories of single items (very easy = 4, rather easy = 3, rather difficult = 2, very difficult = 1) for individuals answering at least 80% of the items included in the specific index. Following this procedure, elevated index values suggest higher HL. To facilitate comparability between indices, the general index and the sub-indices were standardized into a scale from 0 to 50 and the sub-sub-indices into a scale from 0 to 5. These indices were used for data analysis. Reliability using Cronbach's alpha was well above 0.7 for the general index, sub-indices, and most of the sub-sub-indices as well, with only a few at least close to 0.7. The index values for the general index and the sub-indices had normal distribution, with some ceiling effects for higher HL; this was more pronounced for the sub-sub-indices. The somewhat skewed normal distributions indicate that the HLS-EU-Q47 indices are more sensitive and provide more information for lower rather than higher HL scores, which makes sense for most of the research questions. Pearson correlations among and between indices were rather high, namely from r=.89 to r=.93 for the 7 sub-indices with the general index, from r=.70 to r=.81for the sub-indices among each other, from r=.72 to r=.82, r=.54 to r=.84, and r=.42 to r=.69 for the sub-sub-indices with the general index, with the sub-indices, and among each other respectively. These correlations suggest that all indices measure HL, or at least have something in common, but that there is also variation in the perceived difficulty of tasks by specific sub-dimensions of HL.

Concurrent discriminant validity for the general index was investigated for the NVS test. Pearson correlations with the NVS were r=.27 for the general index and r=.24 respectively r=.25 for the domain-specific sub-indices. For the stages of information management, the correlation with the

NVS was somewhat higher for "accessing" and "understanding" (r=.29) than for "appraising" (r=.18) or "applying" (r=.22). A similar pattern was found for the sub-indices. Hence, functional HL measured by a performance-based test explained a certain amount of variation among the comprehensive, self-assessed HLS-EU HL measures but not significantly more than the level of education of the respondents.

Furthermore, categorial levels for the HLS-EU HL measures were defined, as for other HL measures (e.g., the HALS or the NVS), for comprehensive general HL, domain-specific sub-indices, and stage-specific sub-indices; for the sub-sub-indices (due to the small number of items and skewed distributions) it was not advisable to construct these levels. The likelihood of experiencing tasks as being difficult guided the criterion for fixing thresholds. In addition, when constructing the general comprehensive HL index, thresholds were set to minimize 'external' information loss to guarantee that categorized and metric HL indices produced similar correlation strengths and patterns (with the NVS, age, financial deprivation, social status, self-perceived health, and frequency of utilization of doctors). Thresholds were also set to minimize 'internal' information loss by maximizing their correlations with their corresponding metric indices. Like for the four categories of the original items, four levels of HL were defined: inadequate (0–25 pts. or up to 50%), problematic (>25–33 pts. or 51%–66%); sufficient (>33–42 pts. or 67%–80%), and excellent (>42–50 pts. or 81%–100%). For some analyses, the levels of "inadequate" and "problematic" HL were combined and defined as "limited" HL.

1.3.3 Results

This first HL survey in Europe (HLS-EU) indicated that limited HL concerns large groups of the general population in different countries but to varying degrees, namely from 1 out of 3 to 2 out of 3 citizens depending on the country (HLS-EU Consortium 2012; Sørensen et al. 2015). Thus, limited HL is not just a problem for a small minority of citizens. Furthermore, in all countries, there were disadvantaged or vulnerable sub-populations including senior citizens, those with low education, in financial difficulties, or with low self-assessed social status as well as those with low self-assessed health status or frequent use of health care services. Accordingly, a social gradient was found for the HLS-EU HL measures, like for most other HL measures, again varying considerably across countries, with the strongest effects for financial deprivation, self-assessed social status, level of education, and age. The survey also revealed somewhat better HL for women than men.

Concerning the potential consequences of HL, correlation and regression models were investigated for the HLS-EU-Q47 for health behaviors or health risks relating to four variables or indicators: frequency of physical activity, body mass index (BMI), alcohol consumption, and smoking behavior. The strongest significant associations with HL were found for frequency of physical activity, which increased continuously with grouped categories of the index of General HL (for more detailed results, see Pelikan/Ganahl (2017a)).

To investigate health status, the three indicators of the Minimum European Health Module (MEHM) were taken: self-assessed health with an item of SF36, the number of chronic diseases, and the existence of disease-related restrictions. For all three indicators, significant associations were demonstrated with the HLS-EU-Q47, as well as potential direct effects in linear multiple regression models (for more detailed results, see Pelikan/Ganahl (2017a)).

To investigate disease-related behavior, the frequency of using four different kinds of health care services were chosen, and emergency units, hospitals, doctors, and other health care professionals (such as dentists, physiotherapists, psychologists, dieticians, or opticians) were selected as indicators. The associations of comprehensive HL with all four indicators were significant in the HLS-EU data but only to a moderate degree (for more detailed results, see Pelikan/Ganahl (2017a)).

These results demonstrate that HL is relevant for health policy, practice, and research in all participating European countries but should also be measured for each individual country due to the considerable differences in results across countries. The HLS-EU received the European Health Award in 2012 for its societal impact on health policy. In their *Health Literacy: The solid facts,* the WHO already took up the conceptualization and definition of HL and the main results of the HLS-EU survey in 2013.

1.3.4 Short forms of the HL measure

Compared to a performance-based comprehensive test of HL like the HALS, the HLS-EU-Q47 is an efficient instrument. However, even a quick battery of 47 Likert scale items (taking about 10 minutes interview time), which can also be self-administered (Duong et al. 2017) or done online (Nakayama et al. 2015), is regarded as too time-consuming for some HL research intended for general or specific populations. As a result, two short forms, the short-scale HLS-EU-Q16 (3 minutes) and the short-short scale HLS-EU-Q6 (1 minute), were developed using the HLS-EU measure. For the short instruments, the psychometric properties of a unidimensional scale were required to measure comprehensive HL which should represent the scope and underlying theoretical construct of the long form as far as possible. To guarantee unidimensionality, a one-parametric dichotomous Rasch model was used to select items. To do so, the items had to be dichotomized into two categories, "easy" ("fairly" or "very" easy = 1) and "difficult" ("fairly" or "very" difficult = 0). Rasch analyses were then conducted for every country and for the total sample. Three split criteria were used: the median of the distribution, gender, and dichotomized level of education within each country. This resulted in a sub-set of the same 16 items for all countries which satisfied Rasch characteristics for each country although the order of the items occasionally varied. Altogether, these 16 items represented the HLS-EU matrix well, with one exception as no item in the "applying information" cell for "health promotion" in the matrix fulfilled the Rasch criteria. Hence, this cell was not represented in the short form HLS-EU-Q16. Scale values were calculated as simple sum scores and varied between 0 and 16. It was recommended to only calculate scale values for respondents who answered at least 14 items. Correlations with the index of the long form were very high, namely r=.82 for the total sample and varying by country between r=.73 and r=.88. Correlations with functional HL (NVS test) were similar to these of the index of the long form (r=.25 overall and varying between r=.14 and r=.38 for individual countries). The distribution of the HLS-EU Q-16 was J-shaped, with a clear ceiling effect for better HL. Therefore, only three levels were defined: inadequate HL (scale values 0-8), problematic HL (9-12), and adequate HL (13-16).

As expected, the short form was a less robust measure than the long form, having fewer items as well as dichotomized answer categories. Overall, the levels of the long and the short form corresponded in 76% of all cases (varying for countries between 68% and 79%). It was possible to calculate score values for sub-scales of the short form, but levels could not be defined. Correlation patterns with important determinants and potential consequences of HL were very similar for the long and short form of the instrument. In further studies, the Rasch homogeneity of the 16 items was confirmed, e.g., for Austrian adolescents (Röthlin et al. 2013) and migrant populations in Austria (Ganahl et al. 2016), as well as by data from studies of general populations, e.g., for the Czech Republic and for Hungary.

The HLS-EU-Q16 short form contained about a third of the original items and consequently took only a third of the interviewing time, about 3 minutes on average. Nevertheless, even this was regarded as too long for some types of studies. Therefore, another 'short-short-form' containing 6 of the 16 items, was constructed and validated, which took about one minute of interviewing time (for details see Pelikan et al. (2014)). Thanks to these two short forms, the HLS-EU instrument to measure comprehensive HL became available for efficient studies with the option to benchmark them with studies that use the long form of the instrument.

In follow-up studies to the original HLS-EU, the HLS-EU-Q16 and HLS-EU-Q6 measures were investigated further (see Subsection 1.3.5), and additional short forms were developed. First, an Asian short form Q12, based on factor analyses and including one item for each of the 12 cells in the conceptual matrix of HL, was developed using data from Taiwan (Duong et al. 2017) and was later applied to the data of the six countries (Indonesia, Kazakhstan, Malaysia, Myanmar, Taiwan, Vietnam) in the HLS-Asia study (Duong et al. 2019a) as well as to Vietnamese data (Duong et al. 2019b). Later, a Norwegian Q12 short form, also representing the conceptual matrix and based on Norwegian data as well as factor and Rasch analyses, was developed (Finbraten et al. 2018).

Inspired by the Asian and Norwegian short forms and to overcome the shortcomings of the HLS-EU-Q16 and HLS-EU-Q6, a new short form, the HLS-EU-Q12 with 12 items, one for each of the cells in the conceptual HLS-EU matrix, was constructed using the original HLS-EU data for eight countries and two additional countries based on Rasch analyses (Waldherr et al. 2021), https://m-pohl.net/Results). The three short forms with 12 items are similar in as far as in all three the cells in the conceptual matrix are represented by one item, but the individual items selected only partly overlap in the three versions. For the HLS_{19} some of the original wording of the HLS-EU-Q12 was changed as well as the wording of the categories and this HLS_{19}-Q12 was then the short form that was primarily used and validated in the HLS_{19}.

1.3.5 Follow-up studies

The languages used in the original HLS-EU study for the complete HLS-EU-Q86 questionnaire including the 39 correlates, or rather the HLS-EU-Q47 instrument for measuring HL, were Bulgarian, Dutch, English, German, Greek, Polish, and Spanish. Later the complete HLS-EU survey questionnaire or just the HL measure itself were translated into and validated for additional languages (e.g., Albanian, Czech, Danish, French, Hebrew, Hungarian, Italian, Maltese, Portuguese, Russian, Serbo-Croatian, and Turkish). The translated, and partly also extended, questionnaires have been used in population surveys and smaller research projects in many different countries, and versions have also been developed for languages outside Europe (including Indonesian, Japanese, Kazakh, Malay, Burmese (Myanmar), Russian, Traditional Mandarin, and Vietnamese.

Many follow-up studies using the HLS-EU instruments for general populations have been administered and published (based on: Pelikan/Ganahl (2017); Pelikan et al. (2019); Pelikan et al. (2020a); Pelikan et al. (2020b).) The references of this section (1.3.5) can be found in Annex 1, Table 1.1 (this table in the Annex is based on Table 1 in Pelikan et al. (2020) but has been expanded; in Table 8.2 in Pelikan et al. (2019), the studies on general populations are described by the year of the survey, commissioning institution(s), executing institution(s), design and sampling method, regional definition of population, age definition of population, sample size, instrument used for measuring HL, and publications).

For (WHO) Europe:

With the HLS-EU-Q47: Austria, extended sample (Pelikan et al. 2013); Germany HLS-GER (Berens et al. 2016; Schaeffer et al. 2016; Schaeffer et al. 2017a; Schaeffer et al. 2017b; Berens et al. 2018); Greece (Michou et al. 2019a), Ireland (Doyle et al. 2012), Netherlands (van der Heide et al. 2013), Spain (Catalonia (Contel et al., 2015, Garcia-Codina et al., 2019)), Czech Republic (Kučera et al. 2016); Hungary (Koltai/Kun 2016); Italy (Palumbo et al. 2016); Portugal (Espanha/Ávila 2016; Pedro et al. 2016); just one municipality (Azevedo Alves et al. 2018); Kazakhstan (see also Asia) (Baisunova et al. 2016; Duong et al. 2017b); Switzerland (Bieri et al. 2016).

With the HLS-EU-Q47 and a focus on methodological development or validation: HLS-EU total (Pelikan et al. 2018; Lorini et al. 2018); Austria (Gerich/Moosbrugger 2018); Germany, adaption for children (26 items) (Bollweg et al. 2020); Netherlands (van der Heide et al. 2013; van der Heide et al. 2016); Albania (Toçi et al. 2015); Norway (Finbraten et al. 2017; Finbraten et al. 2018); Switzerland, food literacy (Grea Krause et al. 2018); Turkey (Abacigil et al. 2019).

With the HLS-EU-Q16: Belgium, health insured people (Van den Broucke/Renwart 2014; Vandenbosch et al. 2016; Avalosse et al. 2017); Denmark (Svendsen et al. 2020); Israel (Levin-Zamir et al. 2016; Levin-Zamir/Bertschi 2018; Baron-Epel et al. 2019); Malta (Office of the Commissioner for Mental Health 2014).

With the HLS-EU-Q16 (or HLS-EU-Q6) and a focus on methodological development or validation: Netherlands (Pander Maat et al. 2014; Storms et al. 2017); Spain (Nolasco et al. 2018); Belgium, people with low literacy (Storms et al. 2017); Denmark (Fransen et al. 2014); France (Rouquette et al. 2018); Iceland (Gustafsdottir et al. 2020); Italy (Lorini et al. 2017; Lorini et al. 2019); Sweden (Wångdahl et al. 2019; Wångdahl et al. 2020); Turkey (Emiral et al. 2018).

For Africa:

HLS-EU-Q16: Ghana, Ashanti region (Amoah/Phillips 2019).

For Asia:

With the HLS-EU-Q47: six Asian countries (Indonesia, Kazakhstan, Malaysia, Myanmar, Taiwan, Vietnam) (Duong et al. 2017b); Japan Q47 (Nakayama et al. 2015); Kazakhstan (Baisunova et al. 2016); Taiwan (Duong et al. 2015)

With the HLS-EU-Q47 in Asia and a focus on methodological development or validation: six Asian countries, Q12 (Duong et al. 2019a); Japan, validating the HL-SDHQ (Matsumoto/Nakayama 2017); Malaysia, Q18 (Mohamad et al. 2020); Samoa (Bollars et al. 2019); Taiwan (Huang et al. 2018a), Q47>Q12 (Duong et al. 2017c), Rasch model (Huang et al. 2018b), Q12>e-healthy diet literacy (Duong et al. 2020), Rasch model (Huang et al. 2018b); Vietnam Q47>Q12 (Duong et al. 2019b).

With the HLS-EU-Q16 (or HLS-EU-Q6) in Asia and a focus on methodological development or validation: Indonesia, Q16 & HLS-EU-SQ10-IDN (Rachmani et al. 2019).

HLS-EU instruments have also been applied to investigate the HL of specific populations (for details, see Annex 1, Table A 1.1):

» young people/students,
» old people/seniors,
» migrants/refugees/asylum seekers,
» other sub-populations,
» Patients.

Due to the wide-ranging acceptance and up-take of the HLS-EU study design in further HL research projects, it was decided to take this study design as the foundation for the HLS_{19} study and to develop it further, to the extent that this was necessary.

1.4 The European Health Literacy Survey 2019–2021 (HLS_{19}) – the first project for M-POHL

1.4.1 Establishment of the WHO Action Network Measuring Population and Organizational Health Literacy (M-POHL)

Building on the European HL survey (HLS-EU), the WHO's publication *Health Literacy: The solid facts* recommended measuring population and organizational HL regularly in Europe. This was strongly promoted by the health ministers of the German-speaking "quintet countries" (Austria, Germany, Liechtenstein, Luxemburg, and Switzerland), who convinced WHO/Europe to establish an Action Network on Measuring Population and Organizational HL (M-POHL) under the umbrella of its European Health Information Initiative (EHII). M-POHL was launched in February 2018, with currently 28 participating member countries from the WHO European Region, as a network of researchers and policy representatives.

M-POHL's overall aim, as defined in its Concept Note (M-POHL 2018), is to "support the availability of high-quality internationally comparative data on HL as a comprehensive and relational concept". This entails both the institutionalization of periodical comparative surveys on population HL and of organizational health literate or HL-sensitive healthcare organizations, settings, and systems, to facilitate the identification and selection of specific aspects of HL that can be best improved with health policies and strategies.

1.4.2 HLS_{19}: M-POHL's first project

After the publication of the HLS-EU study, many countries who could not participate in the original study did individual follow-up surveys, using the study design of the HLS-EU, and partly extended its methodology by including additional instruments and variables as well as more complex analyses. Their results were published in individual reports or journals meaning that it was difficult to use the results for benchmarking across countries and for consented further development of the methodology. Therefore, it seemed important to again offer the opportunity to participate in a multinational standardized study and to establish a framework for regular follow-up surveys. In the years following the HLS-EU, work on the internal differentiation of the concept of HL was continuing. It was considered important to follow this trend and to use more specific concepts and instruments to measure relevant selected aspects of the comprehensive concept of HL in general populations. Thus, in the HLS_{19}, the intention was once again to measure general, comprehensive population HL in all participating countries but also four specific HLs as optional packages, by volunteering countries. To allow for the inclusion of further specific HL instruments and correlates, it was decided to use the short form HLS_{19}-Q12 of the HLS_{19}-Q47 long form as a common measure for general comprehensive HL across participating countries.

The Health Literacy Population Survey Project 2019–2021 (HLS_{19}) is M-POHL's first project. Its aim was to measure population HL in as many member states of the WHO European Region as possible. To plan and carry out this project, a consortium was established within M-POHL comprising countries planning to participate in the survey, and working groups were formed to develop individual modules in the study design, including optional packages for Navigational HL, Communicative HL with physicians, Digital HL, Vaccination HL, and the costs and economics of HL.

In the end, 17 countries in the WHO European Region – Austria (AT), Belgium (BE), Bulgaria (BG), Czech Republic (CZ), Denmark (DK), France (FR), Germany (DE), Hungary (HU), Ireland (IE), Israel (IL), Italy (IT), Norway (NO), Portugal (PT), Russian Federation (RU), Slovakia (SK), Slovenia (SI), and Switzerland (CH) – participated in the HLS_{19} project in the period 2019–2021.

1.4.3 Main aim and objectives of HLS_{19}

The main aim of the HLS_{19} was to prepare, and – as far as possible – standardize, a European survey of population HL that can also be taken up at regular intervals to report comparative trends over time.

The specific objectives of the HLS_{19} were to:

» provide empirical data for evidence-based HL policies in the HLS_{19} countries, other countries in M-POHL (with observer status), and the larger WHO European Region,
» use the findings to inform policymakers from different sectors and levels about the relevance of HL in their field of decision making,
» provide evidence for knowledge-based recommendations for HL interventions in the fields of health promotion, disease prevention, and healthcare,
» contribute to theoretical, conceptual, and methodological developments in research on population HL in Europe,
» contribute to the knowledge base on which factors and covariates explain variation in HL within and between countries,
» disseminate findings to relevant stakeholders, e.g., policymakers, researchers, healthcare staff, health promotion practitioners, non-governmental organizations, and others, as well as the general public,
» stimulate policies that build further capacities and provide resources for implementing measures to improve HL as well as for researching HL and how it can be implemented effectively,
» support M-POHL in becoming an international resource and expert group on population HL,
» support M-POHL in developing future projects that improve the quality of population HL measurements in the WHO European Region.

Research and development-related activities for the HLS_{19}

To meet the main aim and objectives set in the HLS_{19}, the following main research and development-related activities for the HLS_{19} were initiated, accomplished, and are still ongoing at the time this report was being written:

» development of an HLS_{19} study protocol and survey instruments,
» implementation of a cross-national comparative survey among the HLS_{19} project partner countries,
» establishment of an international HLS_{19} database,
» distribution of results across the HLS_{19} project partner countries for benchmarking,
» publication and dissemination of the findings in reports, scientific peer-reviewed journals, books, factsheets, policy briefing papers, and via the M-POHL public website.

While building conceptually on the HLS-EU study (see Chapters 2 to 4 for how the HLS-EU study design was followed and expanded), the HLS_{19} project had the ambition to consider major trends in HL in response to public health challenges.

1. Navigational HL: Health care systems are becoming more and more complex and difficult to navigate for patients and consumers. Thus, Navigational HL is needed to do this successfully. (Chapter 10)
2. Communicative HL with physicians: Patient/physician communication has a long tradition in health and social sciences but is still seen as problematic. (Chapter 11)
3. Digital HL: Due to digital transformation, Digital HL is already important and will become even more so in the future. (Chapter 12)
4. Vaccination HL: At the time of writing, the Covid-19 pandemic is still ongoing, so we do not have to explain why Vaccination HL is important. But it was included in HLS_{19} long before we knew about Covid-19. (Chapter 13)
5. HL and health-related quality of life as a mediator for health costs: The relation of HL to the costs and economics of health care and beyond is of specific interest for health policy. (Chapter 14)

For more detailed reasons for selecting these topics and argumentation relating to the need for new measures in these fields, see Chapters 10 to 14.

1.4.4 Principal research questions of the HLS_{19}

The principal research questions in the HLS_{19} cover the core project in which General HL is measured and the optional packages which relate to specific HL domains. The overriding research question was:

How are the different HL measures distributed and how are they associated with relevant determinants and health consequences in the participating countries?

The specific research questions for the HLS_{19} were:

» Validation of the new HL measures: How well do they function in different countries? What further developments are necessary?
» Distributions and aggregate measures of the new HL measures: How do these differ across countries?
» Distributions of individual items: Which tasks for dealing with health-related information are most problematic?
» Which specific disadvantaged vulnerable sub-populations can be identified?
» Is there a social gradient for these HL measures?
» How strongly is HL associated with socio-demographic, socio-economic, and additional selected determinants?
» What are the potential health-related consequences of the HL measures? How is HL associated with selected indicators of health behaviour and lifestyle, health status, and health care utilization?
» To what extent does General HL have implications for health-related quality of life and for absenteeism from work due to health problems?
» Which recommendations for policy interventions to improve HL can be given based on the research findings?

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2 Study design

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2.1 Development of the HLS_{19} study design

The HLS_{19} was planned as a cross-sectional multi-center survey study that was meant to be as standardized as possible to allow comparisons across the national surveys that were part of the international study. To ensure this, adequate structures, and procedures for cooperation in the HLS_{19} were developed by the M-POHL consortium. M-POHL relied on the experience and example of the European Commission's HLS-EU study (HLS-EU-Consortium 2012; Sørensen et al. 2012; Sørensen et al. 2013; Sørensen et al. 2015) and was guided by the WHO's Health Behavior in School-Aged Children study (HBSC) (http://www.hbsc.org/) to establish the necessary standards for working together and to create a framework for repeating the study over time. This involved defining the rights and duties of the project partners and implementing certain governance and work structures.

For the HLS_{19}, an International Coordination Center (ICC) was established to enable international coordination and support for the national HLS_{19} Partners. The ICC was situated within the WHO CC for Health Promotion in Hospitals and Health Care in the Department of Health Literacy and Health Promotion at the Austrian National Public Health Institute (Gesundheit Österreich GmbH, GÖG). The HLS_{19} Member Countries (the national partners in the project) had to ensure that national participation took place in accordance with the internationally agreed set of rules, especially those laid down in the HLS_{19} Study Protocol.

The decisions on developments for the HLS_{19} Project were taken jointly by two assemblies of representatives of the HLS_{19} Partners (i.e., the HLS_{19} Policy Assembly and the HLS_{19} Research Assembly). M-POHL members who did not participate in the HLS_{19} Project had observer status for the HLS_{19} Project (i.e., the HLS_{19} Observer Group).

To fulfill the research part, a National Study Center (NSC) was contracted to conduct the HLS_{19} Project in each participating country, providing national data, compiling a country report, and representing their HLS_{19} Member Country at the HLS_{19} Research Assembly. To fulfill the policy role in the HLS_{19} Project, Ministries of Health sent a member of staff or nominated a representative from another suitable institution for the HLS_{19} Policy Assembly.

Following the examples of the HLS-EU and HBSC, specific tasks for preparing the survey were conducted by temporary HLS_{19} Working Groups. These groups were established to deal with underlying research concepts and theories, methodological issues, and thematic areas as well as to translate research findings into policy recommendations.

An HLS_{19} Study Protocol was developed step by step by the HLS_{19} Consortium as a guiding document for any decisions relevant for the research.

A study design for data collection and sampling was developed to keep a balance between standardizing the data collection and sampling within an international multi-center study to enable benchmarking between the data collection in the participating countries. At the same time, it should leave enough room and flexibility for country-specific needs and accommodate countries' practical and financial conditions and necessities. As a result, the study design was sufficiently flexible to facilitate the participation of all interested countries. Regarding the mode of data collection, this flexibility became an asset in the light of the Covid-19 pandemic, which forced some countries to change their previously chosen type of data collection (i.e., face to face) to telephone or online data collection. On the other hand, the different types of data collection limit the comparability of results across participating countries to a considerable degree.

In this chapter, the study design is described in terms of defining the population and sample size, methods of sampling, and the procedures for data collection as well as for translating and field testing the instruments. The development of the instrument itself is then dealt with in Chapter 3.

2.2 The HLS_{19} study design

Definition of the population

The HLS_{19} study population was defined as all permanent residents aged 18 and above living in private households in the countries participating in the study. (This is different from the HLS-EU, which included European citizens aged 15+ years.)

Sample size

A sample size was determined of at least 1,000 persons for each country, which is the same as the standard sample size per country in the HLS-EU. However, most participating countries in the HLS_{19} study chose a larger sample.

As a rule, at least 80% of the HLS_{19} core items, consisting of the 12 items measuring General HL and the 31 correlate items, needed to be answered to be accepted as a complete interview.

Methods of sampling

A multi-stage random sampling procedure was recommended as the main method of sampling, using the Eurobarometer standard as a reference, like in the HLS-EU study. For PAPI/CAPI, it was recommended that the sampling be based on a random selection of sampling points after stratification for gender, age groups, population density, and geographical areas/units. Quota sampling was considered acceptable if the quota were representative of the population regarding the above criteria. For data collection using CATI or CAWI, the methods of sampling were adapted to the characteristics of these methods of data collection (see Subsection 2.4.1 Survey sampling procedure and response rates).

Time frame of data collection

Originally the intention was to collect data between November 2019 and April 2020, but due to the Covid-19 pandemic, the time frame had to be extended, and data were collected between November 2019 and June 2021.

Procedure for data collection

For the HLS_{19} survey, data collection was performed separately in each participating country. In most countries, large data collection agencies were contracted by the National Study Centers to collect the data, but in some countries data collection was done by the National Study Center itself. In contrast, in the original HLS-EU study, data collection was performed by an international agency utilizing Eurobarometer standards for all participating countries.

The recommendation to use personal face-to-face interviews (PAPI or CAPI) as the preferred method for collecting data was given in the HLS_{19} Study Protocol. The reasons for this preference were that personal face-to-face interviews would allow for better comparability with the original HLS-EU study, which had also used face-to-face data collection via either CAPI or PAPI. In addition, face-to-face interviewing makes it possible to use visual cue cards and to include the NVS test, a test of functional HL, for validation purposes. Other advantages of personal face-to-face interviews are that individuals with poor literacy skills are easier to reach and that unfamiliar words and questions may be clarified by the interviewers. Face-to-face data collection also has its disadvantages: data collection is more expensive and time consuming than CATI or CAWI, and respondents might feel more reluctant to share truthful answers on sensitive topics (e.g., financial deprivation). In addition, people may not open the door to interviewers anymore.

For these reasons, CATI and CAWI were also included in the HLS_{19} Study Protocol as acceptable data collection methods. Due to the Covid-19 pandemic, many countries changed their initial preference for CAPI to CATI or CAWI.

Section 2.4.1 gives a detailed description of the guiding standards for data collection and sampling procedures as well as the actual methods of data collection and sampling procedures used by each country.

2.3 Translation and field testing of instruments

2.3.1 Description of the national translation processes

The HLS_{19} instruments were developed in English by the HLS_{19} Consortium (see Chapter 3) and translated into the national languages by the participating countries.

Recommended procedure for the translation process

The HLS_{19} Study Protocol suggested the following procedure for translating the HLS_{19} instruments:

The translation process should have two stages: first, two forward translations should be performed, one by the National Study Center (NSC) and one by the data collection agency. In a second stage, the NSC should compare the two translations and decide, in a consensus process with the agency, on the most appropriate translation in case of differences.

The questions on the correlates of HL in the HLS_{19} instrument are partly identical to items in large international surveys (EHIS, ESS). Notes referring to these initial surveys are provided in the HLS_{19} instruments. A supporting document on the correlate items has also been produced by the ICC to provide guidance and to support the implementation of the correlate items. It is recommended that NSCs should use already existing translations of these items by consulting documents relating to the above-mentioned international surveys.

Many translations of the HLS_{19} instruments were created by the HLS_{19} project partners (see Table 2.1 and Table 2.2 for details of the translated instruments by country). The HLS_{19} instruments were translated into their national language(s) by 16 out of the 17 countries (Ireland used the original English version). Each NSC organized the translation process. This was mostly done by the data collection agencies and/or other professional translation services.

The translation processes are listed in Table 2.1 and Table 2.2. Different national versions of the instruments were created for the German, French, Israeli and Italian translations, namely three German versions (AT, CH, DE), three French versions (BE, CH, FR), three versions for the Israeli population (Hebrew, Arabic and Russian) and two Italian versions (CH, IT), as each participating country adapted the instruments to its cultural, linguistic, and healthcare context. Countries with common languages cooperated in translating the instruments.

The suggested procedure of performing two forward translations was implemented by ten countries (AT, BE (Dutch translation), CH (German translation), DE, DK, HU, IT, NO, SI, and SK). One forward translation was chosen by countries which cooperated with other countries using the same language (BE for the French translation, CH for the French and Italian translations). Although back translation was not required according to the study protocol, it was performed by four countries (IL, NO, RU, and SI).

Moreover, 14 countries chose additional ways of ensuring the quality of the translations, such as

- cognitive interviewing (NO, SI),
- focus groups (RU),
- expert discussion/review (CH, CZ, RU, PT, and SK),
- three forward translations (DK, SI),
- comparison of the translation with the (national) HLS-EU translation (BG, CH, CZ, HU, DK, and NO), and
- cooperation with other countries (AT, CH, DE, BE, and FR).

The final versions of the translated instruments were based on consensus processes in all countries. The different translations and, if applicable, the additional quality assurance methods for the translated instruments were agreed on by the different actors in the translation process.

Although the countries participating in the study did not face any major problems with the translations, some challenges were reported, such as adapting the wording of items to the national context without changing their meaning. A way of dealing with this was to add some examples to support the respondents' understanding. Adapting health service terminology to the national healthcare system was another challenge that was sometimes reported, but solutions were found each time.

Table 2.1:
Overview of the different processes used by each country to translate the instruments

	AT	BE	BG	CH	CZ	DE	DK	FR	HU
Translated languages	German	Dutch, French	Bulgarian	French, German, Italian	Czech	German	Danish	French	Hungarian
One forward translation		x (French)	x	x (French) x (Italian)	x				
Two forward translations	x	x (Dutch)		x (German)		x	x		x
Back translation									
Based on consensus processes	x	x	x	x	x	x	x	x	x
Other quality assurance methods for the translation	x	x	x	x	x	x	x	x	x
The translation procedure applied is marked with an "x"									

Source: HLS19 Consortium

Table 2.2:
Overview of the different processes used by each country to translate the instruments (continued from Table 2.1)

	IE	IL	IT	NO	PT	RU	SI	SK
Translated languages	n.a.	Hebrew, Arabic, Russian	Italian	Norwegian	Portuguese	Russian	Slovenian	Slovak
One forward translation		x			x	x		
Two forward translations			x	x			x	x
Back translation		x		x		x	x	
Based on consensus processes		x	x	x	x		x	x
Other quality assurance methods for the translation				x	x	x	x	x
The translation procedure applied is marked with an "x"								

Source: HLS_{19} Consortium

2.3.2 Description of national field-testing procedures

Recommended procedure for field testing

The HLS_{19} Study Protocol suggested the following procedure for field testing the HLS_{19} instruments:

In each partner country a field test is to be performed with the HLS_{19} instruments. Countries with non-English national languages have to test the translated version of their national HLS_{19}. The field test must be performed by the data collection agency.

Sample size of the field test: 30 interviews. Purposeful sampling is suggested to ensure an equal distribution of participants in terms of age, gender, and education.

The data collection agency should compile a field-test report and send it to the NSC. The field-test report should include information on the participants, the comprehensibility of each item, and the length in minutes of each part of the survey and the full interview, as well as any problems experienced and suggestions for changes, e.g., of the wording of an item.

In the case of an online survey, the aim of the field (or pilot) test is specifically to: (1) check that the questions asked and the proposed response modalities were fully understood by the respondents, (2) validate the average time needed to complete the survey, and (3) consider the need to include short instructions that can be accessed with a simple click, thus allowing respondents to obtain additional information in case the terminology used is not clear.

Field testing was performed to check whether the items in the survey were fully understood by respondents and to assess the feasibility of its implementation using the data collection method chosen for the country. Table 2.3 to Table 2.6 provide an overview of the procedures implemented for field testing in the participating countries, grouped by the main type of data collection. All the countries, except Bulgaria, performed a field test (16 out of 17). The sample size for these field tests varied by country, from six interviews in Belgium to 161 interviews in Italy, but for most countries, the field tests involved at least 30 completed interviews (8 out of 16 countries). Germany was the first country to conduct the national field test (in November 2019). The German field-test results were taken into consideration when developing the final English version of the HLS_{19} instruments. None of the countries experienced major difficulties during the field test, and only slight changes were made due to the results of the field testing and interviewers' feedback in 12 countries (AT, BE, CH, CZ, DE, FR, HU, IT, NO, PT, SK, and SI). Such changes concerned language adaptions, removing brackets around examples, adding examples, and clarifying instructions for the interviewers.

Countries that selected interviewees by purposeful sampling used gender, age groups, educational levels, degrees of urbanity, and administrative regional units (whereby different mixes of these criteria were used). Switzerland made use of intentional oversampling for younger and older age groups. Portugal decided to select Portuguese-speaking immigrants as interviewees for field testing to ensure that the language was accessible to all population groups. In eight countries (BE, CZ, DK, FR, IL, NO, RU, and SK), respondents were selected by convenience sampling. Additional test methods relating to all or part of the HLS_{19} instruments were applied in six countries; these included in-depth cognitive analyses (CH), setting up focus groups (PT, RU), additional testing of the instruments by staff (DE) or a team of researchers (FR, IE), and expert interviews (DE, RU).

Countries that used CATI reported that they needed to adapt the wording of the instrument slightly because the visual cue cards for response categories could not be used (such visual cue cards were used with CAPI/PAPI). An example of an adaption is changing the interviewer's instruction for items measuring HL from "On a scale from very easy to very difficult, how easy would you say it is?" to "On a scale from very easy, easy, difficult, and very difficult, how easy would you say it is?".

Countries that used CAWI had to find a solution to deal with the possible response "don't know/does not apply". When using CAPI/PAPI and CATI, the "don't know/does not apply" category was not a direct option for the respondents but had to be coded by the interviewer as "no answer". Some countries using CAWI did not provide the option for "don't know/does not apply". In France, the poll company suggested keeping all items mandatory as the participants were members of a panel and keen to respond to all items. In Switzerland, the "don't know/does not apply" option was not displayed on the screen to prevent participants from choosing it without trying to understand the question. The option only appeared if participants did not tick any of the four answer categories and tried to continue, with the questions not answered indicated in red. The message text was: "please answer all questions; if this is not possible, click continue". In case a participant clicked “continue” without filling in an answer, the software automatically coded the answer as “don’t know/does not apply”.

In Italy both CATI and CAWI were used. The response category “don’t know/does not apply” was explicitly offered for both data collection formats. The Italian field test revealed that CATI respondents showed a lower propensity to indicate the “very difficult” and “difficult” response options, despite being older and having a lower level of education than the interviewees targeted for CAWI. To reduce this effect, interviewers were instructed to specify at the beginning of the interview that there were no right or wrong answers and that it was particularly important that respondents answered each item truthfully.

Table 2.3:
Overview of the different field-testing procedures used in countries where CAPI/PAPI was the main method of data collection

Countries using CAPI/PAPI			
	DE	RU	SK
No. of interviews >=30	x	x	x
Purposeful sampling	x		
Convenience sampling		x	x
Additional test method(s) applied	x	x	
The procedure applied is marked with an “x”			

Source: HLS19 Consortium

Table 2.4:
Overview of the different field-testing procedures used in countries where CATI was the main method of data collection

Countries using CATI					
	AT	HU	IE	NO	PT
No. of interviews >=30	x	x	x	x	
Purposeful sampling	x	x	x		x
Convenience sampling				x	
Additional test method(s) applied			x		x
The procedure applied is marked with an “x”					

Source: HLS19 Consortium

Table 2.5:
Overview of the different field-testing procedures used in countries where CAWI was the main method of data collection

Countries using CAWI				
	BE	CH*	DK	FR
No. of interviews >=30		x		
Purposeful sampling		x		
Convenience sampling	x		x	x
Additional test method(s) applied		x		x

* CH: CAWI was the main type of data collection and a small number of CATI interviews were carried out. In field testing both CAWI and CATI were used.
The procedure applied is marked with an "x"

Source: HLS19 Consortium

Table 2.6:
Overview of the different field-testing procedures used in countries where mixed methods were the main method of data collection

Countries using mixed methods					
	BG	CZ	IL	IT	SI
Type of method(s) used for field test	*No field test performed*	CAPI	CAWI	CAWI, CATI	CAPI
Type of method(s) used in main data collection	CAPI, CAWI	CAWI, CATI	CAWI, CATI	CAWI, CATI	CAPI, CAWI, paper and pencil
No. of interviews >=30			x	x	x
Purposeful sampling				x	x
Convenience sampling		x	x		
Additional test method(s) applied					

The procedure applied is marked with an "x"

Source: HLS19 Consortium

2.4 Data collection and processing

2.4.1 Survey sampling procedures and response rates

Preliminary remark: The planning phase for the HLS19 started in 2018 with the aim of collecting data in 2019 and 2020. As the Covid-19 pandemic progressed, some partner countries which had initially planned face-to-face data collection decided to change to methods without physical contact.

In Table 2.7 and Table 2.8Table 2.7, details of survey sampling and response rates are presented by country and grouped by the main type of data collection respectively, providing an overview of the standard procedures used as well as on differences and similarities in procedures and performances. For each procedure, the approach recommended in the HLS_{19} Study Protocol is shown in an information box.

Detailed recommendations when using PAPI/CAPI

For countries using CAPI or PAPI for data collection, it is suggested to draw samples from the general population using a multi-stage random sampling procedure. Quota samples are also acceptable. In each country a number of sampling points is to be drawn with probability proportional to population size and density. The drawing of sampling points has to be done in a systematic way in each stratum so that the number of interviews is equal to the proportion of the strata in the population aged 18 years and over. As a next step, it is suggested to randomly draw a starting address in each of the selected sampling points. Then, further addresses are to be selected as every N^{th} address using the standard random route procedure from the initial address. A respondent in each household is to be drawn using "the nearest birthday" method or the Kish method. Up to four attempts were allowed to obtain an interview with the selected respondent. No more than one interview should be conducted in each household.

Details of survey sampling and response rates in the countries using CAPI/PAPI as the main method of data collection can be found in Table 2.7.

In Germany, multi-stage random and quota sampling were combined to ensure the representativeness of the sample. First, sampling points in administrative regional units (NUTS2 level) were selected randomly bearing population density in mind. In those areas, respondents were sampled/recruited using a community-based quota sampling approach, with quota for gender in combination with age, size of household, and education.

In the Russian Federation, a multi-stage random sampling procedure was applied in three selected regions. Out of a list of all medical institutions in each of the three regions, 13 medical institutions (for Novosibirsk and Tatarstan) and ten medical institutions (for Karelia) were randomly selected, taking the proportion of people living in urban and rural areas into account. In each medical institution selected, four therapeutic areas were randomly selected for each region and then in each therapeutic area, the sampling of addresses (households) was also selected randomly. In Slovakia the sample was calculated by NUTS2. However, the data collection was organized via regional public health offices (36 across Slovakia) and the samples were then calculated by catchment areas to fulfill the national sample.

The number of net interviews in which 80% of the core items were answered are the basis for the data analyses in this international report. These varied from 2,143 in Germany to 5,660 in the Russian Federation. The response rates (calculated as the number of net interviews/number of individuals contacted) varied between 94% in the Russian Federation and 64% in Germany, while Slovakia had a response rate of 67%. The especially high response rate in the Russian Federation might be a result of the interviewers, i.e., doctors (therapists and paramedics) working in the Centers for Medical Prevention, who are well known and trusted by the population.

Table 2.7:
Details of survey sampling and response rates in the countries using CAPI/PAPI as the main method of data collection

Countries using CAPI/PAPI			
	DE (PAPI)	RU (PAPI)	SK (CAPI)
Sampling procedure	Multi-stage random and quota sampling	Multi-stage random sampling	Multi-stage random sampling
Source for the selection of households	Randomly selected sampling points combined with a community-based quota sample with 558 sampling points, which equaled the number of interviewers	List of household addresses in four therapeutic areas of selected medical institutions in the three regions: Novosibirsk, Karelia, and Tatarstan	36 regional public health offices
Number of sampling points (=interviewers)	558	48	42
Number of individuals contacted	3,394	6,926	3,220
Number of net interviews	2,162	6,493	2,171
Number of net interviews with 80% of the core items answered	2,143	5,660	2,145
Response rate %	64	94	67

Source: HLS_{19} Consortium

Detailed recommendations when using CATI

For the telephone surveys, households should be selected using a random selection procedure in stages as described in PAPI/CAPI (see above). A CATI system should randomly generate landline numbers using the Random Digit Dialing (RDD) procedure. A dual-frame approach should be applied to ensure the inclusion of both landline phone and mobile phone users.

Details of survey sampling and response rates in the countries that used CATI as the main method of data collection can be found in Table 2.8. Of these countries, Austria and Hungary used multi-stage random sampling procedures. While in Austria the Randomized Last Digit Method was used, in Hungary a hybrid form of sampling was used in which stratification was based on regions/type of settlements (as in the face-to-face mode) to define the case numbers to achieve while ensuring random selection within the sample frame by using a pool of phone numbers drawn from public registries. Complemented by a quota controlling for gender/age/region/type of settlement during fieldwork, this ensured a representative sample with the same level of random selection as in the case of face-to-face surveys. In Ireland, random selection of mobile phone numbers using a Random Digit Dialing approach was used as the sampling procedure. In Norway, sample management was significantly improved by stratification of the random sample. This methodology splits the population into smaller groups from which a random sample is drawn from each stratum. This method ensures the correct proportion of the different population groups. In Portugal, the sampling procedure was also based on stratified random sampling, with placement according to the Portuguese population on the following variables: number of residents by NUTS III, gender, and large age groups. A dual-frame approach including landline phone and mobile phone was implemented in four countries (AT, HU, NO, and PT), while in Ireland only mobile phone numbers were included.

The number of net interviews with 80% of the core items answered, serving as the basis for the analyses presented in this international report, varied from 1,195 in Hungary to 4,487 in Ireland.

The response rate (calculated as the number of net interviews/number of individuals contacted) was highest in Portugal at 69% and lowest in Hungary at 14%.

Table 2.8:
Details of survey sampling and response rates in the countries using CATI as the main method of data collection

	Countries using CATI				
	AT*	HU	IE	NO	PT
Sampling procedure	Multi-stage random sampling procedure	Multi-stage random sampling procedure	Random digit dialing approach	Random sampling procedure within each stratum	Random stratified sampling procedure
Dual-frame approach applied	Yes	Yes	No	Yes	Yes
Source for the selection ofof telephone numbers	Registry of landline and mobile telephone numbers	Online public phonebook	Registry of mobile phone numbers	Registry of landline and mobile telephone numbers	Registry of landline and mobile telephone numbers
Number of telephone contacts	28,558	13,381	22,866	39,371	6,749
Number of individuals contacted	22,704	8,654	16,730	15,008	2,257
Number of net interviews	3,535	1,221	4,530	3,000	1,555
Number of net interviews with 80% of the core items answered and included in the HLS19 international analyses	2,967	1,195	4,487	2,855	1,247
Response rate %	16	14	27	20	69

* In AT, data collection included additional interviews on a regional level (n=509) which were not used in the international analyses but which could not be extracted when calculating the response rate.

Source: HLS19 Consortium

Detailed recommendations when using CAWI

For CAWI, a representative sample of the national population is usually constituted from a panel of internet users. To that effect, the following stepwise sampling procedure is to be followed: (1) A first group of potential respondents is selected from the panel based on established inclusion criteria (residents of the country aged 18–75 years); (2) Preselected potential respondents are invited by e-mail to participate in the survey; (3) For those who agree to participate, compliance with the inclusion criteria is verified; those who comply with the criteria can access the instrument via a personalized login; (4) After a first wave of responses, a second wave of potential respondents is selected from the panel according to the pre-established quotas (defined by gender, age group, population density, and geographical areas/units) that are underrepresented; (6) This procedure is repeated until the sample is representative of the population for the pre-established quotas.

Details of survey sampling and response rates for the countries that used CAWI as the main method of data collection can be found in Table 2.9. Four countries used CAWI as the main type (BE, CH, DK, and FR). Quota sampling was used in Belgium and in France, where respondents were sampled from a pre-existing online access panel. Switzerland and Denmark used multi-stage random sampling to select respondents. Respondents in Switzerland were selected from the SRPH registry and an invitation letter was sent to all sampled individuals including a CAWI link; in case they preferred a telephone interview, a toll-free phone number was provided. In Denmark the sample was based on the Register of Civil Registration Numbers.

The number of net interviews with 80% of the core items answered, which are the basis of the analyses presented in this international report, varied from 1,000 in Belgium to 3,602 in Denmark. The response rate (calculated as the number of net interviews/number of invited participants) was highest in Switzerland, where 54% of the invited participants completed the survey. For Belgium, where data collection was carried out by an external organization using automated multi-source sampling, the number of invited participants (and response rate) is not available.

Table 2.9:
Details of survey sampling and response rates in the countries using CAWI as the main method of data collection

	Countries using CAWI			
	BE	CH*	DK	FR
Sampling procedure	Quota sampling	Multi-stage random sampling	Multi-stage random sampling	Quota sampling
Source for the selection of respondents	Online panel	SRPH registry	Register of Civil Registration Numbers	Online panel
Number of participants invited (e-mail, letter)	–	4,764	27,727	47,102
Number of invited participants who agreed to participate	–	4,560	4,605	15,262
Number of net interviews	1,000	2,348 (+ CATI 210) Total: 2,558	3,679	2,003
Number of net interviews with 80% of the core items answered and included in the HLS19 international analyses	1,000	2,312 (+ CATI 190) Total: 2,502	3,602	2,003
Response rate %	–	54**	13	4

* CH: CAWI was the main type of data collection; additionally, a small number of CATI interviews were conducted.
** Response rate for both types of data collection.

Source: HLS19 Consortium

Detailed recommendations when using multiple or mixed methods

When mixed methods are used for data collection, the recommendations for the specific data collections described above apply.

Details of survey sampling and response rates for the countries using mixed or multiple methods can be found in Table 2.10.

Bulgaria used a random quota sample for CAWI and a proportional stratified sampling procedure for CATI. The Czech Republic used CAWI and CATI for data collection, with random quota sampling for CAWI and a random digital procedure for CATI. Israel, where a combination of CAWI and CATI was used, and Slovenia, where CAPI, CAWI, and paper and pencil were applied, both chose a multi-stage random sampling strategy. In Slovenia, respondents were sampled from the Central Population Registry. In Italy, a proportional stratified sampling procedure selecting respondents randomly was applied for CATI and CAWI data collection.

The number of net interviews with 80% of the core items answered, which are the basis for this international report, was 865 for Bulgaria, 1,315 for Israel, 1,599 for the Czech Republic, 3,360 for Slovenia, and 3,500 for Italy.

In Bulgaria, the CAWI sample of net interviews with 80% of the core items answered (463) was slightly higher than the CATI sample (402). In the Czech Republic, the CAWI sample of net interviews with 80% of the core items answered (1,067) was twice as high as the CATI sample (532), CATI being selected to contact the older population, which was less represented in the e-mail registry. In Israel, CATI sampling focused on the Arab population, which was expected to be more difficult to reach via the internet panel; 311 net interviews with 80% of the core items answered were collected by CATI and 1,004 by CAWI. In Italy, the CATI survey was targeted primarily at over 65 year olds and CAWI at younger people. However, to allow a comparative analysis of the possible effects derived from using two data collection tools, both methodologies were applied to all age groups. Out of the 3,500 Italian net interviews with 80% of the core items answered, 2,949 were collected by CAWI and 551 by CATI. In Slovenia, 1,860 net interviews with 80% of the core items answered were collected by CAPI, 1,488 by CAWI, and 12 by self-administered paper-and-pencil questionnaire, with the mixed-method mode used to increase the response rates to a maximum level despite the Covid-19 pandemic. The procedure in Slovenia was as follows: Invitation letters were sent to all 6,000 people in the sample, inviting them to participate online and informing them that an interviewer would come and visit them for personal interviews if they did not complete the online questionnaire within the next seven days. Interviewers were instructed to make up to four contact attempts in person, at different times on different days, and then visited the selected respondents at their home addresses. If the latter did not want to complete the questionnaire with an interviewer, they were again reminded that they could do it online or were even offered a self-administered paper-and-pencil questionnaire with a return prepaid envelope to send it back.

Table 2.10:
Details of survey sampling and response rates in the countries using mixed methods for data collection

	Countries using mixed methods										
	BG		CZ		IL		IT		SI		
Type of method(s) used in the main data collection	CAWI	CATI	CAWI	CATI	CAWI	CATI	CAWI	CATI	CAPI	CAWI	Paper and pencil, self-administered
Sampling procedure	Random quota sampling	Proportional stratified sampling	Random quota sampling	Random digital procedure	Multi-stage random sampling		Proportional stratified sampling		Multi-stage random sampling		
Dual-frame approach applied (CATI only)		–	–	x	–	x		x	–	–	–
Source for the selection of respondents	Internet panel	Telephone register	Online panel	Main public telephone directory	Online panel	Telephone register	SWG Panel Community	Main public telephone directory	Central Population Registry	Central Population Registry	Central Population Registry
Number of initial contacts (addresses/telephone numbers) or invited participants (e-mail, letter)	1,654	1,238	3,455	9,952	9,400	1755	13,441	11,075	6,000		
Number of individuals contacted in CAPI/CATI/ paper and pencil or number of invited participants who agreed to participate in CAWI	948	912	1,797	4,635	1,861	300	7,627	4,973	5,585		
Number of net interviews	555	402	1,070	580	1,004	300	3,357	582	3,412		
Number of net interviews with 80% of the core items answered and included in the HLS_{19} international analyses	463	402	1,067	532	1,004	311	2,949	551	1,860	1,488	12
	Total: 865		Total: 1,599		Total: 1,315		Total: 3,500		Total: 3,360		
Response rate %	59	44	31	13	54	18	25	12	61*		

* Response rate for all types of data collection calculated as the number of net interviews/number of individuals contacted in CAPI/CATI/paper and pencil or the number of invited participants who agreed to participate in CAWI.
“x”=yes, “–”=no

Source: HLS_{19} Consortium

2.4.2 Study population and representativeness

Definition of study population

The HLS_{19} study target population is permanent residents aged 18 years and older living in private households.

Recommended procedure for stratification

To increase representativeness, stratification is suggested for gender, age groups, population density, and geographical areas/units. For stratification by age group, seven age groups are suggested: 25 or younger, 26–35, 36–45, 46–55, 56–65, 66–75, 76 or older. As for stratification for population density, three categories are suggested: predominately urban, intermediate, and predominately rural. According to this definition, predominantly urban regions have a rural population of less than 20%, intermediate regions between 20% and 50%, and predominantly rural regions more than 50%. For non-EU countries a similar classification should be used. NUTS2[1] areas/units are suggested for stratification by geographical area/unit. Non-EU countries should use equivalent standards.

Table 2.11 to Table 2.14 provide details regarding the representativeness of the samples, including the key demographics used for stratification when selecting the sample and the data on which stratification was based. All countries targeted the permanent resident population aged 18 years and older living in private households. None of the countries carried out purposeful oversampling or undersampling of subpopulations.

Details regarding the study population and representativeness of the sample for countries using CAPI/PAPI as the main method of data collection are shown in Table 2.11. Limitations regarding representativeness must be considered for the sample of the Russian Federation, for which respondents were selected from only three regions, Novosibirsk, Karelia, and Tatarstan. The Russian Federation has highly heterogeneous areas and populations, and therefore it is not possible to draw conclusions regarding the whole country based on data from just three regions. The Russian Federation also reported that the age group of 75+, especially men in rural areas, was the least covered, since men in rural areas usually die at a younger age.

Stratification for key demographics was applied to different degrees. Further variables for stratification were used in Germany and Slovakia. Target distributions were based on the 2018 microcensus in Germany, on national census data from 2019 in the Russian Federation, and on national census data from 2018 in Slovakia.

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[1] NUTS: nomenclature of territorial units for statistics as used by the statistical office of the European Union (EUROSTAT).

Table 2.11:
Details of study population and representativeness in countries using CAPI/PAPI as the main method of data collection

	Countries using CAPI/PAPI		
	DE	RU	SK
Limitations on representativeness		(1) Representative for the three regions, not the whole country (2) Age group 75+ less covered	
Variables considered for stratification/quota sampling			
» Gender	x	x	x
» Age groups (no. of groups)	x (5)	x (7)	x (7)
» Population density	x	–	x
» Administrative regional units (NUTS level or other)	x (NUTS2)	–	x (NUTS2)
» Other variables, described	3 levels of education and 2 groups by size of household	–	36 Regional Public Health Office areas
Stratification/quota based on (which data)	Microcensus 2018	National census 2019	National census 2018

"x"=yes, "–"=no

Source: HLS_{19} Consortium

Details regarding the study population and representativeness of the sample for countries that used CATI as the main method of data collection are shown in Table 2.12. One major limitation in representativeness in CATI was that people with secret or non-listed phone numbers (in Norway) or those who did not make their phone numbers and names available for the purpose of phone surveys (in Hungary) could not be contacted. In Ireland, only mobile phone numbers were used, but as there is near-universal ownership of mobile phones in Ireland, this is unlikely to have impacted representativeness. Portugal included the mainland population and not that of its islands.

Stratification for key demographics is shown in Table 2.12. In Ireland no stratification was carried out on the target population with target distributions based on census data.

Table 2.12:
Details of study population and representativeness in countries using CATI as the main method of data collection

	Countries using CATI				
	AT	HU	IE	NO	PT
Limitations on representativeness		People who did not allow the authorities to make their phone numbers and names available for the purpose of phone surveys were excluded	Only mobile phone numbers were used (but near-universal ownership of mobile phones in Ireland)	People with secret or non-listed phone numbers were excluded	Mainland population included/no population from the islands included
Variables considered for stratification/quota sampling					
» Gender	X	x	–	x	x
» Age groups (no. of groups)	x (7)	x (3)	–	x (7)	x (3)
» Population density	X	–	–	–	–
» Administrative regional units (NUTS level or other)	x (NUTS2)	x (NUTS2)	–	x (11 regional units)	x (NUTS3)
» Other variables, described	3 levels of education	3 levels of education	–	–	–
Stratification/quota based on (which data)	Microcensus 2017	National census 2011	n.a.	National census 2020	National census 2011

"x"=yes, "–"=no

Source: HLS19 Consortium

Details regarding the study population and representativeness of the sample for countries that used CAWI as the main method of data collection are shown in Table 2.13. In France and Belgium, one limitation was that only participants belonging to a pre-existing online panel were sampled. In France people aged 76 or older were not covered. Denmark reported that individuals without an official e-mail ("e-box") were excluded, but since this concerns only a small proportion of Danish residents, this is considered a minor limitation. Stratification for key demographics was applied to different degrees in the countries. Target distributions were based on census data (see Table 2.13).

Table 2.13:
Details of study population and representativeness in countries using CAWI as the main method of data collection

	Countries using CAWI			
	BE	CH*	DK	FR
Limitations on representativeness	Only participants of an online panel	–	Individuals without official e-mail "e-box" were excluded (=small proportion of Danish residents)	Only participants of an online panel (IPSOS i-say), people aged 76 or older were not covered
Variables considered for stratification/quota sampling				
» Gender	x	x	x	x
» Age groups (no. of groups)	x (3)	x (7)	x (7)	x (6)
» Population density	–	x	x	x
» Administrative regional units (NUTS level or other)	x (Region)	x (NUTS3)	–	x (NUTS2)
» Other variables, described	–	–	–	–
Stratification/quota based on (which data)	National census 2011	National census, 2020	National census Q4, 2020	National census 2015

* CH: CAWI was the main type of data collection; additionally, a small number of CATI interviews were conducted.
"x"=yes, "–"=no

Source: HLS_{19} Consortium

Details about the study population and representativeness of the sample for countries that used mixed or multiple methods for data collection are shown in Table 2.14. A possible limitation on representativeness is that the internet panel might oversample people with high Digital Health Literacy. Another factor affecting representativeness might be the timing of the data collection.

Variables considered for stratification/quota sampling are detailed in Table 2.14.

Table 2.14:
Details of study population and representativeness in countries using mixed methods for data collection

	Countries using mixed methods				
	BG	CZ	IL	IT	SI
Limitations on representativeness	The internet panel probably oversamples people with high Digital Health Literacy.				
Variables considered for stratification/quota sampling					
» Gender	x	x	x	x	x
» Age groups (no. of groups)	X (12)	x (4)	x (7)	x (7)	x (13)
» Population density	–	x	–	x	–
» Administrative regional units (NUTS level or other)	X (NUTS2)	x (NUTS3)	–	X (NUTS2)	x (NUTS3)
» Other variables, described	Location (city/ village)	3 levels of education	Geographical periphery measure	–	4 levels of education
Stratification/quota based on (which data)	National Census 2011	National census 2011 and 2019	Israel Central Bureau of Statistics	National census 2020	National census 2020

“x”=yes, “–”=no

Source: HLS_{19} Consortium

2.4.3 Fieldwork

Recommended procedure for fieldwork

For performing data collection, it is suggested that the HLS_{19} National Study Centers sign a contract with data collection agencies. The data collection agency should ensure high quality data collection and provide detailed documentation of the fieldwork.

Table 2.15 to Table 2.18 provide information on who performed the data collection, the time taken for data collection, and the average length of interviews in minutes as well as the shortest and longest interview times. Data collection was carried out in most of the participating countries by national data collection agencies and in three cases by the HLS_{19} National Study Centers (BG, DK, and SK).

The planning phase for the HLS_{19} started in 2018 with the aim of collecting data in 2019 and 2020. Due to the Covid-19 pandemic, the timeframe for collecting data was extended and the data collection phase lasted from November 2019 until June 2021.

The timeframe for data collection in the Russian Federation was from November to December 2019 and in Germany[2] from December 2019 to January 2020, so in both countries, data were collected before the Covid-19 pandemic. All other participating countries started data collection during the pandemic, which reached different phases of intensity in the different countries at different points in time. Slovenia started data collection in March 2020 and had to stop after six days due to the pandemic, starting a second wave of data collection from June 2020 to August 2020. For Belgium, the first part of data collection took place just before the pandemic, with a second part during the pandemic.

In the Czech Republic there was a spike in the second Covid-19 pandemic wave in November 2020, with many restrictions and measures. At that time the public debate on vaccination also started. Many health- and vaccination-related items might have unusual results due to this distortion. Some segments of the population (e.g., elderly, people with chronic diseases) might have reacted more sensitively than others.

The average length of the interviews varied between 13 min in Israel and Italy for CAWI respondents and 65 min in Germany (PAPI). Differences in the average length of the interviews depend on the number of items included in the questionnaire and the different types of data collection. In Denmark, where CAWI was used for data collection, the length was measured from opening the survey to finishing the last page (the median length was 22 minutes).

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DE conducted an additional round of data collection in August and September 2020 in order to assess the effects of Covid-19 on HL. These data were not included in this report but were analyzed and reported on a national level.

Table 2.15:
Details of fieldwork in countries using CAPI/PAPI as the main method of data collection

Countries using CAPI/PAPI			
	DE (PAPI)	RU (PAPI)	SK (CAPI)
Data collection performed by	Institut fuer Demoskopie Allensbach GmbH	Center of Medical Prevention of the Republic of Karelia, Regional Center of Medical Prevention of the Novosibirsk region, Regional public organization "Golden Heart", Republic of Tatarstan	Regional Offices of Public Health managed by the Public Health Authority of the Slovak Republic (HLS_{19} National Study Center)
Time of data collection	13.12.2019–27.01.2020	01.11.2019–20.12.2019	22.06.2020–14.09.2020
Average interview length (in minutes)	65	28	28
Shortest interview (in minutes)	15	8	10
Longest interview (in minutes)	180	120	95

Source: HLS_{19} Consortium

Table 2.16:
Details of fieldwork in countries using CATI as the main method of data collection

Countries using CATI					
	AT	HU	IE	NO	PT
Data collection performed by	Das Österreichische Gallup Institut	TÁRKI Social Research Institute	Ipsos MRBI	Norstat Norge AS	Universidade de Aveiro – CIMAD – Centro de Investigação em Marketing e Análise de Dados
Time of data collection	16.03.2020–26.05.2020	02.12.2020–20.12.2020	24.07.2020–07.12.2020	04.04.2020–13.05.2020	10.12.2020–13.01.2021
Average interview length (in minutes)	26	23	29	21	15
Shortest interview (in minutes)	15	10	20	8	9
Longest interview (in minutes)	60	84	60	59	30

Source: HLS_{19} Consortium

Table 2.17:
Details of fieldwork in countries using CAWI as the main method of data collection

Countries using CAWI				
	BE	CH*	DK	FR
Data collection performed by	Medistrat	M.I.S. Trend	Aalborg University and Aalborg University Hospital (HLS19 National Study Center)	IPSOS
Time of data collection	30.01.2020–28.02.2020 and 01.10.2020–26.10.2020	05.03.2020–29.04.2020	11.12.2020–05.02.2021	27.05.2020–05.06.2020 and 08.01.2012–18.01.2021
Average interview length (in minutes)	–	16 (CATI: 21)	39	22
Shortest interview (in minutes)	–	5 (CATI: 8)	2	10
Longest interview (in minutes)	–	110 (CATI: 104)	1,435	329

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

Source: HLS19 Consortium

Table 2.18:
Details of fieldwork in countries using mixed methods for data collection

	Countries using mixed methods										
	BG		CZ		IL		IT		SI		
Type of method(s) used in the main data collection	CATI	CAWI	CAWI	CATI	CAWI	CATI	CAWI	CATI	CAPI	CAWI	Paper and pencil
Data collection performed by	Faculty of Public Health, Medical University, Sofia		STEM – Ústav empirických výzkumů, z.ú		Sekernet	Statnet	SWG spa		IPSOS Slovenija		
Time of data collection	15.08.2020–30.11.2020	1.04.2021–1.06.2021	10.11.2020–24.11.2020		15.12.2020–10.1.2021		08.04.2021–08.05.2021		9.3.2020–15.3.2020 (stopped due to Covid-19) and 9.6.2020–10.8.2020		
Average interview length (in minutes)	30	15	19	34	13	19	13	14	28	31	–
Shortest interview (in minutes)	15	10	7	12	–	14	7	7	7	6	–
Longest interview (in minutes)	45	30	111	102	–	24	27	33	124	–	–

"–"=no information available

Source: HLS_{19} Consortium

2.4.4 Data quality checks and data weighting

Recommendation to perform quality checks on data and to weight the sample

The HLS19 Study Protocol suggests that national samples should be weighted by gender, age group, population density, and geographical areas/units, based on national census data to increase representativeness. Quality checks for data entry and outcomes are recommended.

Table 2.19 to Table 2.22 provide an overview of the data quality checks on data entry and outcomes, information on weighting by demographics, and the source of data used for applying weights. Quality checks on data entry and outcomes were performed by all participating countries. Weight factors used to weight respondents by gender were included in all country data sets. Fourteen countries weighted their data for different socio-demographic factors; two countries (PT and SK) did not weight their data. For weighting by age groups, the number of age groups varied between three and thirteen, with most countries using seven groups as suggested in the HLS19 Study Protocol. Population density was either weighted using three groups, predominately urban, intermediate, and predominately rural (AT, CH, DE, DK, and IT) or by two groups differentiating between urban and rural areas (FR, RU), or by four quota categories (CZ). For weighting by administrative regional units, NUTS2 was used in Austria, France, and Italy. Switzerland and Slovenia used NUTS3. Other administrative geographical units were used in Germany (17 federal states, whereby West Berlin and East Berlin were included separately), Norway (11 administrative geographic units), and Belgium (three regions). Levels of education were used for weighting the data by six countries (AT, CZ, DE, HU, IE, and SI).

Table 2.19:
Details of data quality checks and data weighting in countries using CAPI or PAPI as the main method of data collection

Countries using CAPI/PAPI			
	DE	RU	SK
Quality checks on data entry performed	x	x	x
Quality checks on data outcomes performed	x	x	x
Weighted by gender	x	x	–
Weighted by age group (no. of groups)	x (7)	x (7)	–
Weighted by population density (no. of groups)	x (3)	x (2)	–
Weighted by administrative regional units (NUTS level or other)	x (17 federal states, whereby West Berlin and East Berlin were included separately)	–	–
Other weighting	8 levels of education	–	–
Weights are based on (which data)	Microcensus 2018	National census 2019	–

"x"=yes, "–"=no

Source: HLS19 Consortium

Table 2.20:
Details of data quality checks and data weighting in countries using CATI as the main method of data collection

	Countries using CATI				
	AT	HU	IE	NO	PT
Quality checks on data entry performed	x	x	x	x	x
Quality checks on data outcomes performed	x	x	x	x	x
Weighted by gender	x	x	x	x	–
Weighted by age group (no. of groups)	x (7)	x (3)	x (7)	x (7)	–
Weighted by population density (no. of groups)	x (3)	–	–	–	–
Weighted by administrative regional units (NUTS level or other)	x (NUTS2)	–	–	x (11 units)	–
Other weighting	3 levels of education	3 levels of education, 3 settlement types	9 levels of education	–	–
Weights are based on (which data)	Microcensus 2017	National census 2011	Labour Force Survey 2020	National census 2020	–

“x”=yes, “–”=no

Source: HLS_{19} Consortium

Table 2.21:
Details of data quality checks and data weighting in countries using CAWI as the main method of data collection

	Countries using CAWI			
	BE	CH*	DK	FR
Quality checks on data entry performed	x	x	x	x
Quality checks on data outcomes performed	x	x	x	x
Weighted by gender	x	x	x	x
Weighted by age group (no. of groups)	x (3)	x (7)	x (7)	x (7)
Weighted by population density (no. of groups)	–	x (3)	x (3)	x (2)
Weighted by administrative regional units (NUTS level or other)	x (regions)	x (NUTS3)	–	x (NUTS2)
Other weighting	–	–	–	–
Weights are based on (which data)	National census 2011	National census 2020	National census Q4, 2020	National census 2015

* CH: CAWI was main type of data collection; additionally, a small number of CATI interviews were conducted.
“x”=yes, “–”=no

Source: HLS_{19} Consortium

Table 2.22:
Details of data quality checks and data weighting in countries using mixed methods for data collection

	Countries using mixed methods				
	BG	CZ	IL	IT	SI
Quality checks on data entry performed	x	x	x	x	x
Quality checks on data outcomes performed	x	x	x	x	x
Weighted by gender	x	x	x	x	x
Weighted by age group (no. of groups)	x (12)	x (4)	x (10)	x (7)	x (13)
Weighted by population density (no. of groups)	–	x (4)	–	x (3)	–
Weighted by administrative regional units (NUTS level or other)	x (NUTS2)	–	–	x (NUTS2)	x (NUTS3)
Other weighting	Location (city/village)	3 levels of education	Religion	–	4 levels of education
Weights are based on (which data)	National Census 2011	Data from demographic yearbook	Israel Central Bureau of Statistics	National census 2020	National census 2020

"x"=yes, "–"=no

Source: HLS_{19} Consortium

2.4.5 Ethical considerations, data protection, and informed consent by country

Recommendations for ethical approval, data protection, and informed consent

In countries where national regulations foresee a review of ethical conduct requirements (e.g., through ethics committees at universities), it has to be ensured that these countries meet these requirements. Where such requirements and ethics committees are not in place, countries are required to adhere to national ethical guidelines concerning population surveys and submit their protocol to any relevant board at national level.

Furthermore, each country participating in the HLS_{19} was required to:

» comply with applicable national data protection legislation (EU countries additionally needed to comply with the EU General Data Protection Regulation (GDPR) (Regulation (EU) 2016/679 2016),
» guarantee that study participants were fully informed about the research and procedures in place to enable them to withdraw from the study easily,
» employ written and/or oral procedures for informed consent, and
» fully document their national procedures.

In Table 2.23 and Table 2.24, details of ethical approval, compliance with data protection rules, and informed consent are shown by country. National regulations on the need to perform a scientific ethical review vary and ten countries had to get approval from an ethics committee. One country (DE) was not obliged to obtain such approval but applied for it nevertheless and was granted it. All participating countries ensured compliance with data protection and explicitly obtained informed consent from respondents before carrying out any interviews.

Table 2.23:
Details of ethical approval, compliance with data protection rules, and informed consent

	AT	BE	BG	CH	CZ	DE	DK	FR	HU
Ethical approval needed?	–	–	–	–	–	–	–	x	x
Ethical approval obtained?	–	–	–	–	–	x	–	x	x
Compliance with data protection ensured?	x	x	x	x	x	x	x	x	x
Informed consent obtained?	x	x	x	x	x	x	x	x	x
"x"=yes, "–"=no									

Source: HLS_{19} Consortium

Table 2.24:
Details of ethical approval, compliance with data protection rules, and informed consent (continued from Table 2.23)

	IE	IL	IT	NO	PT	RU	SI	SK
Ethical approval needed?	x	x	x	x	x	x	x	x
Ethical approval obtained?	x	x	x	x	x	x	x	x
Compliance with data protection ensured?	x	x	x	x	x	x	x	x
Informed consent obtained?	x	x	x	x	x	x	x	x
"x"=yes, "–"=no								

Source: HLS_{19} Consortium

2.5 Summary of study design and its implementation in the HLS19: Discussion and conclusions

This chapter describes the HLS_{19} study design, especially the translation and field testing of the instruments as well as methods of data collection and processing.

The main features of the cross-sectional study design developed and decided on by the HLS_{19} Consortium and its working groups were to do a national survey for adults aged 18 and above living in private households in the 17 participating countries. A minimum sample size of 1,000 was defined, but most countries used larger samples. A multi-stage random sampling procedure was recommended as a main standard for the methods of sampling, using stratification for gender, age group, population density, and geographical areas/units. Quota sampling was considered acceptable if the quota were representative of the population regarding the above criteria. For data collection using CATI or CAWI, the methods of sampling were adapted to the characteristics of these methods of data collection. Using personal face-to-face interviews (PAPI or CAPI) was recommended, but CATI and CAWI were also included in the HLS_{19} Study Protocol as being acceptable and were used more often than originally planned due to Covid-19. The time frame for data collection was originally planned for November 2019 to April 2020 but had to be extended to June 2021 due to the Covid-19 pandemic. Countries had to find and commission a suitable agency to carry out data collection.

Although in principle based on the HLS-EU, the HLS_{19} deviates from the HLS-EU study protocol in more than one aspect, which makes a comparison of results with the HLS-EU rather difficult. Of the 17 participating countries, four had already participated in the original HLS-EU study (AT, BG, DE, and IE), another nine had administered their own national survey at a later date using the HLS-EU study design and instrument (BE, CH, CZ, DK, HU, IL, IT, NO, and PT), while four countries carried out their first national population survey on HL in the HLS_{19} study (FR, RU, SI, and SK).

For the translation and field testing of instruments, recommendations were provided, which were adhered to by countries to varying extents.

The same holds true for the methods of data collection administered by the individual countries. Four "pure" types of data collection were used: PAPI (by DE and RU), CAPI (by SK), CATI (by AT, HU, IE, NO, and PT), and CAWI (by BE, CH (with a few CATI), DK, and FR). There were also mixed types, namely CAWI + CATI (by BG, CZ, IL, and IT) and CAPI + CAWI (by SI). In addition to these different types of data collection, individual types were administered quite differently in detail by the countries employing them (e.g., selecting and approaching respondents, kind of interviewers, presenting questions in interviews, realized response rates).

Therefore, the comparability of results between countries participating in the HLS_{19} is severely limited, more so for univariate measures than for measures of association. Due to further differences, a comparison of results from earlier HLS-EU studies with results from the HLS_{19} is even more restricted.

The different kinds of data collection used in the countries participating in the HLS_{19} and in the HLS-EU studies can affect the results in different ways:

First, different kinds of data collection use different procedures and sources of data to construct the samples, which can therefore represent different populations (Robling et al. 2010). Hoebel et al. (2014) found that socio-demographic characteristics differed significantly between study participants in paper, telephone, and online data collection procedures. Cornesse/Bosnjak (2018) found that web surveys have a significantly lower representativeness compared to other survey methods. It can be hypothesized that for personal interviews, better representation can be obtained of vulnerable groups in the population than for CATI or CAWI. This can partly be demonstrated by looking at the raw distributions of representativeness indicators in samples. Possibly, these effects can be dealt with partly by using weighting procedures.

Second, while most countries used probability samples, quota sampling was also used by some countries, partly due to the kind of data collection chosen, e.g., CATI, which can have effects on the representativeness of the raw sample.

Third, the response rates can differ for the three modes of data collection, which is clearly demonstrated by the considerable differences in response rates achieved for national samples in the HLS_{19} study.

Fourth, the different communication situations when the interviewer is personally present, on the telephone, or when a computer is used can have different effects. According to the literature, one consistent result is that people interviewed by telephone tend to give more positive answers to scale questions than people completing online questionnaires (Christian et al. 2008; Lugtig et al. 2011; Ye et al. 2011) and that online surveys yield more accurate and complete responses than telephone surveys (Chang/Krosnick 2009; Kreuter et al. 2009). Fessler et al. (2018) looked at variation in interview modes in the Austrian EU SILC panel and found that a switch from CAPI to CATI led to major changes in response behavior (unit and item non-response) and answering behavior (potential misreporting), leading to large differences in estimated inequality measures.

In addition, differences in sample size may affect the precision of the results.

Collecting data in different seasons of the year, with the respondents' experiences of illness at the time of the survey differing, may also influence responses on health-related issues. Moreover, the national surveys took place in different stages of the Covid-19 crisis, and the communication strategies used by the countries also differed.

Conclusions

The differences in the way the study design was fulfilled across countries severely restrict direct and precise comparisons between the HLS_{19} countries, and even more so with the results of earlier HLS-EU studies. Nevertheless, this international study of 17 countries trying to follow a common study design as far as possible offers a rare opportunity to study general trends and ranges in variation for HL across countries in the WHO European Region.

2.6 References

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3 The HLS$_{19}$ instruments

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3.1 Development of the HLS$_{19}$ instruments

Working groups were established by the HLS$_{19}$ Consortium to develop the HLS$_{19}$ instruments for measuring General HL as well as selected specific forms and aspects of HL (Navigational HL, Communicative HL, Digital HL, Vaccination HL, the costs and economics of HL), and to identify correlates relevant for potential determinants and consequences of HL. The proposals of the working groups were discussed and approved by the HLS$_{19}$ consortium.

The HLS$_{19}$ instruments on General HL were based on the HLS-EU instrument and its conceptual framework and definition of HL so the HLS$_{19}$ instruments on General HL cover three domains in which dealing with health-relevant information is needed: healthcare (or managing illness), disease prevention and health promotion, and the four key competencies of health-related information management: to access/obtain, understand, appraise/judge/evaluate, and apply/use information relevant for health (see Chapter 1, Figure 1.1 for the matrix of subdimensions of HL based on the HLS-EU conceptual model). The HLS$_{19}$ instruments for measuring specific forms and aspects of HL used the format of the instrument for measuring General HL as much as possible.

3.1.1 The HLS19 instruments measuring General HL: long and short versions

Building on the HLS-EU-Q47

The generic HLS$_{19}$ instruments, which measure General HL and consist of 12, 16, or 47 items (and are termed HLS$_{19}$-Q12, HLS$_{19}$-Q16, and HLS$_{19}$-Q47 respectively), were based on the HLS-EU instruments.

The HLS-EU instrument consists of 47 items for measuring comprehensive General HL (referred to as the HLS-EU-Q47) and 39 correlates of HL (HLS-EU-Consortium 2012; Sørensen et al. 2012; Sørensen et al. 2015; Sørensen et al. 2013b). The HLS-EU-Q47 – the long form – was first developed, validated, and applied in eight countries (Austria, Bulgaria, Germany (North Rhine-Westphalia), Greece, Ireland, Netherlands, Poland, and Spain) in seven languages (Bulgarian, Dutch, English, German, Greek, Polish, and Spanish) by the initial HLS-EU study and was subsequently validated and used for general population samples in follow-up studies of the survey in the following countries in the WHO European Region: Albania, Czech Republic, Hungary, Israel (Hebrew, Arab, Russian), Italy, Lithuania, Norway, Portugal, Switzerland (German, French, Italian, Portuguese, Turkish), and Turkey. It was since been used in Asia in Indonesia, Japan, Kazakhstan, Malaysia, Myanmar, Taiwan (Mandarin), and Vietnam, as well as for research in other European countries such as in Serbia, in the Americas such as in Brazil (Brazilian Portuguese) and Mexico, and in Asia, such as in Hong Kong and Sri Lanka (Sinhalese) (for details, see Pelikan/Ganahl (2017a); Pelikan/Ganahl (2017b); Pelikan et al. (2019); Pelikan et al. (2020)).

Experiences with the HLS-EU-Q47 showed that it was perceived as taking a long time to complete (10 minutes). As a result, two short forms of the instrument were constructed to measure HL: the HLS-EU-Q16 (about three minutes) and the HLS-EU-Q6 (about one to two minutes).

Besides the original eight countries with seven languages, the HLS-EU-Q16 short version was also validated and used in population studies in Belgium (Dutch, French), Denmark, France, Iceland, Israel (Hebrew, Arabian, Russian), Italy, Kazakhstan, Malta (Maltese, English), Sweden (Swedish, Arabic), and Turkey. Translated versions have also been used for research in Finland, Egypt (Arabic), Ethiopia (Amharic), Ghana (Twi), and China (Mainland Mandarin).

The 6-item version of the HLS (HLS-EU-Q6) has been used in the original eight countries (Austria, Bulgaria, Germany, Greece, Ireland, Netherlands, Poland, and Spain) representing seven languages (Bulgarian, Dutch, English, German, Greek, Polish, and Spanish) but also in France and Italy (for details, see Pelikan et al. (2020)).

Independently, another two short forms based on the HLS-EU-Q47 containing twelve items each were developed: an Asian version (Duong et al. 2019a; Duong et al. 2017b) and a Norwegian version (Finbraten et al. 2017; Finbraten et al. 2018). The Asian version was developed by explorative and confirmatory factor analyses (EFA, CFA) while the Norwegian one was validated by testing the data against the unidimensional Rasch model for polytomous data, also referred to as the Partial Credit Model (Masters 1982)

The HLS-EU-Q12 was developed by taking the disadvantages of the HLS-EU-Q16 into account and building on the two available 12-item short forms (the Norwegian HLS-Q12 and the Taiwanese HL-SF12). On the basis of data from the eight HLS-EU countries, Item Response Theory analyses were conducted to achieve maximum overlap with the HLS-EU-Q16 and to identify a 12-item set with the lowest deviance from the assumptions of the Partial Credit Model (PCM; (Masters 1982)) when analyzed separately for each HLS-EU-8 country (Waldherr et al. 2021). Data from the following countries went into the construction of the HLS-EU-Q12: Austria, Bulgaria, Germany (North Rhine-Westphalia), Greece, Ireland, Netherlands, Poland, and Spain (from the HLS-EU study) as well as survey data from Hungary and the Czech Republic.

Criteria in the development of the HLS-EU-Q12 were that the 12 items should reflect the 12 cells of the HLS-EU matrix and form a locally independent scale (unidimensional and no response dependency) with acceptable data-model fit when using the Partial Credit Model (Waldherr et al. 2021).

As such, the HLS-EU-Q12 is not only slightly shorter than the HLS-EU-Q16 but also better represents the underlying model and definition of the HLS-EU instruments.

The HLS$_{19}$-Q47 and the short forms HLS$_{19}$-Q12 and HLS$_{19}$-Q16

Based on the different versions of the HLS-EU, in the HLS$_{19}$ different forms for measuring HL were offered: the **HLS$_{19}$-Q47**, the **HLS$_{19}$-Q12**, and a set of 22 items which, besides being used for the HLS$_{19}$-Q12, were used to construct the **HLS$_{19}$-Q16**. For countries measuring HL for the first time, it was recommended to use the **HLS$_{19}$-Q47**, but a minimum for each country was to measure the **HLS$_{19}$-Q12.**

Changes in the wording of response categories and selected items

The decision was made to remove the original qualifier “fairly” from the 4-point rating scale as it is prone to be translated and interpreted differently in different countries. This ensures that a more uniform understanding is likely after translation into different languages.

Therefore, in the HLS$_{19}$ instruments, the phrases anchored in the 4-point rating scale response categories were changed from “very difficult” – “fairly difficult” – “fairly easy” – “very easy” (as used in the HLS-EU) to “very difficult” – “difficult” – “easy” – “very easy”. Removing the word “fairly” from the two response categories in the middle of the 4-point rating scale was informed by empirical evidence from field testing in Norway, which showed fewer problems with unordered response categories after removing the phrases anchored with the middle/central categories).

A “don’t know” category was not included, as in the HLS-EU but was coded by the interviewer as “no answer” (for CAPI/PAPI and CATI).

In addition, some of the HLS-EU items were revised for the HLS$_{19}$ instruments measuring General HL. Revisions involved rewording items as well as adding or removing examples within items. For changes in the HLS$_{19}$, the following criteria were applied:

Criteria for revising the wording of items included:

» wording which was too complex or words which are difficult to understand (based on expert views and qualitative studies) (Domanska et al. 2018; Finbraten et al. 2018; Storms et al. 2017),
» the harmonization of similar terms (e.g., health and well-being, examples of types of media),

» indications based on quantitative aspects such as high non-response rates in the HLS-EU, response dependency, item fit (under-discriminating items, differential item functioning (Finbraten et al. 2017; Finbraten et al. 2018; Huang et al. 2018) and additional analyses of HLS-EU (unpublished).
» items should clearly relate to dealing with health information.

Criteria for removing or adding examples:

» use of gender-neutral examples (e.g., removing breast exam),
» adaptation to societal changes in lifestyle and health-related or medical practices.

Table A 3.1 in Annex 3 highlights the differences between the HLS-EU-Q47 and the HLS_{19}-Q47 instruments.

The HLS_{19} instruments were first field tested by Germany in November 2019. The German field-test results were considered for the development of the final English version of the HLS_{19} instruments (see Subsection 2.3.2).

3.1.2 Core and optional correlates of General HL

Theoretical framework for selecting correlates

The theoretical framework for selecting correlates (determinants and consequences) for the HLS_{19} was the HLS-EU conceptual model of HL (see Figure 1.1, Chapter 1) (Sørensen et al. 2012), which was refined to create the Vienna Model of Health Literacy (Pelikan/Ganahl 2017a). According to the Vienna Model (see Figure 1.2, Chapter 1), individual or personal HL is influenced by personal determinants like socio-demographic and socio-economic factors (such as gender, age, educational level, migration background) on the one hand and situational determinants on the other hand. Personal HL, in turn, can directly influence lifestyle-related health behaviors, like tobacco and alcohol consumption, physical activity, and nutrition. Personal HL can have a direct and indirect influence on indicators of health status, like self-perceived health and long-term illnesses/health problems. Long-term illnesses/health problems could also be considered a personal determinant of HL. Illness-related behaviors (e.g., the extent of utilization of health care services) can be directly influenced by HL, and indirectly by its effects on health behaviors and health status. Furthermore, health behaviors, health status, and illness behaviors can also be influenced by personal and situational determinants. The model also allows (albeit smaller) causal or cyclical effects in the opposite direction.

Further criteria for selecting correlates in the HLS_{19}

Indicators for correlates were selected based on the conceptual model, on specified research questions, and also by following analyses done in previously published studies using the HLS-EU data as well as other analyses in international publications. The following research questions were agreed upon by the Consortium:

» How valid are the HL measures and what are their psychometric characteristics?
» How are the HL measures and their individual items distributed in general and in relevant subpopulations in the participating countries?
» How strongly are the HL measures associated with socio-demographic, socio-economic, and additional, pre-selected potential determinants?
» Is there a social gradient for the HL measures?
» How are the HL measures associated with potential consequences of HL in connection with the
    » indicators of health behaviors and lifestyles,
    » health status indicators, and
    » indicators of health care utilization?

The selection criteria required that the correlates to be included either had to be potential determinants or consequences of HL, moderating or mediating determinants, or consequences of HL (see Vienna Model of Health Literacy (Pelikan/Ganahl 2017a)). If possible, they should have already been used in the HLS-EU or in other HL or health-related studies (e.g., EHIS). In addition, a theory-based hypothesis regarding an association with HL (not just with health) had to be ensured. For correlates already used in the HLS-EU, indicators were omitted if they did not work well, were rephrased, or if there were similar, better options in other studies.

Criteria for the wording of items:

» inclusion in international/national standard instruments, like the EHIS, ESS, and EU-SILC,
» easy to interpret by respondents and researchers,
» easy to answer for respondents (questions and categories not too wordy),
» simple and efficient; not taking too much time in interviews,
» categories adequate for statistical data analysis,
» possibility of building indices for a set of indicators by standardizing the format of item wording and categories (e.g., for health care utilization, healthy lifestyle).

Core and optional correlates

The HLS_{19} differentiated between core correlates, which all countries had to use, and optional correlates, which could be chosen purposely by countries to deal with problems of instrument length, interview time, and costs as well as to allow for specific national adaptations and the addition of items. The NSCs of participating countries needed to make sure that, if possible, they used already existing translations of included items by consulting documents relating to relevant international surveys such as the EHIS. The final HLS_{19} instruments for General HL include 31 core correlates and 18 optional correlates.

Determinants of HL with selected indicators investigated in this International Report:

The following core determinants were used in the HLS_{19} analyses in this International Report (for General HL in Chapter 6):

Socio-demographic determinants:

» gender
» age.

Socio-economic determinants:

» education
» level in society
» financial deprivation.

Additional determinants:

» migration
» training in a healthcare profession
» status of employment
» long-term illnesses/health problems (whereby long-term illnesses/health problems was analyzed in the HLS_{19} in two ways, both as a determinant and as a possible consequence of HL (see below)).

Indicators of potential consequences investigated in this International Report:

Associations of HL with the following indicators of potential consequences were investigated in this International Report (for introductions on detailed measurements of the indicators and results, see the relevant chapters):

Health behavior and lifestyles (for General HL in Chapter 7):

» BMI
» physical activity
» smoking behavior
» alcohol consumption
» fruit and vegetable consumption.

Health status (for General HL in Chapter 8):

» self-reported health
» long-term illnesses/health problems (whereby long-term illnesses/health problems was analyzed in the HLS_{19} in two ways, both as a determinant (see above) and as a possible consequence of HL)
» limitations due to health problems.

Health care utilization (for General HL in Chapter 9):

» utilization of emergency services
» utilization of GPs/family doctors
» utilization of medical or surgical specialists
» utilization of inpatient hospital services
» utilization of day patient hospital services.

3.1.3 Specific HL measures and their correlates: optional packages

In the HLS_{19} additional, optional packages were developed to measure specific aspects of HL which participating countries could select. Working groups were established for each of the six optional packages (the instrument identifiers are in brackets):

» Digital HL (HLS_{19}-DIGI),
» Communicative HL with physicians in healthcare services (HLS_{19}-COM-P-Q11 (long form)/HLS_{19}-COM-P-Q6 (short form)),
» Navigational HL (HLS_{19}-NAV),
» Vaccination HL (HLS_{19}-VAC),
» Cost and health economics of HL (HLS_{19}-ECON), and
» Functional HL measured by the Newest Vital Sign Test (NVS).

Each working group provided a rationale, including background information and an overview of selected literature, research questions, and suggestions for analyses. An instrument (partly based on existing tools) was developed for each optional package.

The instruments, analyses, and results of the optional packages are described in detail in Chapters 10 to 14.

National add-ons

Participating countries added items to their survey which were important for health policy issues in their country.

Items on concern about the Covid-19 pandemic and the Corona HL Questionnaire were such national add-ons: During the data collection phase for the HLS_{19} Project, the Covid-19 pandemic started, and in most countries data collection was performed during the pandemic. Therefore, an additional question "How much are you personally concerned about the situation caused by Corona?", with the response categories "strongly" – "fairly" – "somewhat" – "not at all", was recommended for inclusion in the questionnaire and was at least used by Austria and Israel. Furthermore, an additional questionnaire on Covid-19, the Corona Health Literacy Questionnaire (Griebler 2020), including 16 items on obtaining, understanding, judging, and basing one's own decisions on information about being infected with the coronavirus, was developed and proposed to the participating countries, with the response categories “very easy” – “easy” – “difficult” – “very difficult”. The Corona Health Literacy Questionnaire was used in Italy.

3.2 Overview of the final HLS_{19} instruments

The final HLS_{19} national instruments comprised different components (see Table 3.1), including core (mandatory) and optional packages or optional items:

1. A core measurement of comprehensive General HL:
   - the HLS_{19}-Q12 (consisting of 12 items) or
   - a set of 22 items (consisting of the HLS_{19}-Q12 plus 10 further items from the HLS-EU-Q47 to allow the HLS_{19}-Q16 to be analyzed as well), or
   - the full version, the HLS_{19}-Q47, consisting of 47 items.
2. 31 core correlates on determinants and potential consequences of HL.
3. Optional packages and optional items to be selected:
   - 18 optional correlates on determinants and consequences of HL,
   - optional packages on measures of specific aspects of HL including correlates of these specific aspects of HL,
   - national add-ons, referring to country-specific questions related to topics of importance for national policy.

Table 3.1:
Overview of the HLS_{19} instruments including core and optional parts/items

	Instrument	Number of items measuring HL	Number of correlates	Total number of items
Core	**General HL measures**			
	HLS_{19}-Q12	12		12
	Set of 22 items (Q12 & Q16)	22		22
	HLS_{19}-Q47	47		47
	Correlates			
	Core correlates		31	31
Optional	Optional correlates		18	18
	Measures of specific aspects of HL/Optional packages			
	HLS_{19}-NAV	12		12
	HLS_{19}-COM-P-Q11 (long form)/ HLS_{19}-COM-P-Q6 (short form)	11 6		11 6
	HLS_{19}-DIGI	10	6	16
	HLS_{19}-VAC	4	10	14
	HLS_{19}-ECON		18	18
	NVS	7		7
	Additional national items			
	To be defined by the participating countries			

Source: HLS_{19} Consortium

In Section 3.4 an overview of the implementation of the HLS_{19} instruments, correlates, and additional optional items by country is shown.

3.3 Description of the generic HLS_{19}-Q12 instrument

Since countries had to include at least the 12 items from the HLS_{19}-Q12 in their surveys, the analyses in this International Report are mainly based on the HLS_{19}-Q12 scores. Therefore, the HLS_{19}-Q12 instrument is presented here in more detail. For an overview of the items of the HLS_{19}-Q47 as well as the set of 22 items which permit calculation of the HLS_{19}-Q16 and the HLS_{19}-Q12, see Table A 3.2 in Annex 3, (for a comparison of the short forms HLS_{19}-Q12 and HLS_{19}-Q16 with the long form HLS_{19}-Q47, see Section 5.6.).

Table 3.2 introduces the HLS_{19}-Q12 instrument and its item numbers as well as the related item numbers in Q22 and Q47. The wording of the items is also included.

Table 3.2:
The HLS_{19}-Q12 instrument, item numbers in the Q12 and Q47, and item wording

Item no. in Q12	**Item no. in Q47**	**Item wording** On a scale from very easy to very difficult, how easy would you say it is:
1	CORE-HL4	…to find out where to get professional help when you are ill? *[instructions: such as doctor, nurse, pharmacist, psychologist]*
2	CORE-HL7	…to understand information about what to do in a medical emergency?
3	CORE-HL10	…to judge the advantages and disadvantages of different treatment options?
4	CORE-HL16	...to act on advice from your doctor or pharmacist?
5	CORE-HL18	…to find information on how to handle mental health problems? *[Instruction: stress, depression or anxiety]*
6	CORE-HL23	…to understand information about recommended health screenings or examinations? *[Instructions: e.g., colorectal cancer screening, blood sugar test]*
7	CORE-HL24	...to judge if information on unhealthy habits, such as smoking, low physical activity or drinking too much alcohol, are reliable?
8	CORE-HL31	…to decide how you can protect yourself from illness using information from the mass media? *[Instructions: e.g., Newspapers, TV or Internet]*
9	CORE-HL32	…to find information on healthy lifestyles such as physical exercise, healthy food or nutrition?
10	CORE-HL37	…to understand advice concerning your health from family or friends?
11	CORE-HL42	...to judge how your housing conditions may affect your health and well-being?
12	CORE-HL44	…to make decisions to improve your health and well-being?

Source: HLS_{19} Consortium

In Table 3.3, the items in the HLS_{19}-Q12 are positioned according to the conceptual matrix model (Sørensen et al. 2012). One item is allocated to every cell of the matrix. For the positioning of the items of the HLS_{19}-Q47 in relation to the definitions and conceptual matrix model of the HLS-EU consortium (Sørensen et al. 2012), see Table A 3.3, Annex 3.

Table 3.3:
Categorization of the items in the HLS_{19}-Q12 (using the item numbers for the Q12 and Q47) in relation to the conceptual model of HL according to Sørensen et al. (2012)

Health literacy	Access/obtain information relevant to health	Understand information relevant to health	Appraise/judge/evaluate information relevant to health	Apply/use information relevant to health
Health care	1/CORE-HL4	2/CORE-HL7	3/CORE-HL10	4/CORE-HL16
Disease prevention	5/CORE-HL18	6/CORE-HL23	7/CORE-HL24	8/CORE-HL31
Health promotion	9/CORE-HL32	10/CORE-HL37	11/CORE-HL42	12/CORE-HL44

Source: HLS_{19} Consortium

3.4 Overview of the implementation of the HLS_{19} instruments in the participating countries

Participating countries could choose between the HLS_{19}-Q12, HLS_{19}-Q16, and HLS_{19}-Q47 as well as select different optional items according to national interests (such as optional correlates, the "concern about Corona" item, and other national add-ons). The also could choose to include optional packages to measure specific aspects of HL.

Table 3.4 provides an overview of the implementation of all core and optional parts of the HLS_{19} instruments in the participating countries. The core instruments and selected items included in the main analyses of the International Report are marked in bold. The instrument on measuring Navigational HL (HLS_{19}-NAV) was included in the national data collection by eight countries. The optional package on Communicative HL with physicians in health care services was implemented by nine countries; three countries included the 11-item long version HLS_{19}-COM-P-Q11, and six countries included the short version HLS_{19}-COM-P-Q6, which is a subset of the long form. Twelve countries chose all of the items in the optional package on Digital HL (HLS_{19}-DIGI), and one country (NO) used only the items on the HL measures (but not the correlates). Therefore, it was possible to compute a comparable score for 13 countries. The full optional package on Vaccination HL (HLS_{19}-VAC), which includes a 4-item VAC-HL measure and 10 correlates, was used by seven countries; as four more countries used the HLS_{19}-Q47, information at least on VAC-HL could be gained. Items on Cost and health economics of HL (HLS_{19}-ECON) were used by three countries, whereby none of them used the full instrument. The instrument on functional HL (NVS) was implemented by two countries (Table 3.4).

Table 3.4:
Overview of the implementation of the HLS_{19} instruments, correlates, and additional optional items by country

	AT	BE	BG	CH	CZ	DE	DK	FR	HU	IE	IL	IT	NO	PT	RU	SI	SK	No. of countries
HLS_{19}-Q47			x			x				x		x	x			x		6
Set of 22 items (Q12 & Q16)		x	x		x	x	x	x	x	x	x	x	x		x	x	x	14
HLS_{19}-Q12	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	17
Additional HL items when using 22 items or Q12	x			x											x		x	4
31 core correlates	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	17
Selected optional correlates	x			x		x	x	x	x	x			x		x		x	11
HLS_{19}-NAV	x	x	(x)	x	x	x		x					(x)	x		x		8
HLS_{19}-COM-P-Q11	x					x							(x)			x		3 + (1)
HLS_{19}-COM-P-Q6	x	x	x		x	x	x	x	x				(x)			x		9 + (1)
HLS_{19}-DIGI	x	x	(x)	x	x	x	x	x	x	x	x		(x)	x			x	12 + (1) +(1)
HLS_{19}-VAC	x	x	(x)*		x	(x)*			x	x		(x)*	(x)*	x		x		7+ (4)
HLS_{19}-ECON							(x)			(x)			(x)					(3)
NVS						x									x			2
National items	x	x		x	x	x	x	x	x	x	x	x**	x	x		x		13
Total number of items used	119	132	94	90	108	176	134	148	97	159	75	94	149	94	71	156	82	

* In 4 counties 4 items on VAC-HL were measured by using HLS_{19}-Q47

** IT used the full 'Corona Health Literacy Questionnaire' (Griebler/Nitsche 2020) after translating it in Italian language

x=all items of an instrument used, (x)=only selected items of an instrument used

items included in the analyses of the main part of the International Report are in **bold**

Source: HLS_{19} Consortium

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4 Methods

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4.1 Introduction

The results of the HLS_{19} study will be made available through three different types of media: (1) through this International Report, aimed primarily at health policy makers in the WHO European Region; (2) through peer-reviewed publications, aimed primarily at the international research community; and (3) through fact sheets on HL measurement tools, aimed primarily at practitioners and researchers.

The methods of data analysis and formats of the presentation of results used in this International Report aim to be as simple as possible but as complex as necessary to answer the research questions concerned. As with the entire HLS_{19} study, the methods and presentations of data analyses are based partly on the procedures used in the HLS-EU study. The International Report aims to demonstrate general trends in the results across all participating countries and the extent of variation in these trends across countries. To do that, methods were used that worked well enough across all countries.

At the same time, the authors of the International Report abstained from optimizing methods for individual countries, which must be left to the National Reports of those countries. Furthermore, the International Report does not aim to explain differences in the results among countries, which may be due in part to different methods of data collection. The International Report should, nevertheless, present the results for individual countries in such a way that allows countries to compare their results with general trends and with the results of countries with which they want to compare themselves. More sophisticated methods and detailed analyses are planned for peer-reviewed publications on selected topics.

It is intended that each chapter in the International Report can be understood independently, while cross-references to other chapters with more detailed information are indicated where necessary. With the support of appropriate captions, labels, and footnotes, both tables and figures should be self-explanatory.

After showing the distributions of HL items (and their correlations in the annex to each chapter) and constructing scales, the statistical analysis was first based on univariate statistics to represent the distributions of HL measures (Chapter 5 for General HL). Second, bivariate associations between the scale scores and socio-demographic and socio-economic variables were conducted to help identify the main health literacy determinants, which were investigated further using multivariable linear regression analyses (Chapter 6 for General HL). Multivariable linear regression models were also used to examine the predictive value of General HL concerning potential health-related consequences of HL (Chapters 7 to 9 for General HL). For specific measures of HL, all the steps of the analyses are included in the relevant chapters (Chapters 11 to 15).

The construct validity of the general and specific HL measures was established using methods from Classical Test Theory (e.g., Cronbach's alpha for internal consistency and Confirmatory Factor Analysis for the factor structure) and Item Response Theory (e.g., the Rasch model).

4.2 Construction of the HL scales

General Health Literacy (GEN-HL) scores

For the International Report, General Health Literacy (GEN-HL) scores were calculated primarily for the HLS_{19}-Q12 and, in specific cases, also for the long form HLS_{19}-Q47 and the short form HLS_{19}-Q16 (cf. Chapters 5 to 7).

The construction of the score values deviates from the HLS-EU study because using the mean of items with an ordinal, bipolar 4-point Likert scale was criticized when the equidistance of the four response categories is not guaranteed. In the HLS_{19} study, 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 contained valid responses; in other words, if less than 80% of the items contained valid responses, the score is set to “missing”. A higher score value signifies a higher level of health literacy.

Specific HL measures

In addition to the GEN-HL score for the HLS_{19}-Q12 that was used throughout the International Report, Chapters 11 to 15 on optional packages introduce measures for specific health literacies. These measures and scores are:

HL-NAV	Navigational Health Literacy score (12 items)
HL-COM-Q11	Communicative Health Literacy with physicians in health care services score (11 items)
HL-COM-Q6	Communicative Health Literacy with physicians in health care services score (6 items, i.e., a short form of HL-COM-11 just including six of the 11 items)
HL-DIGI	Digital Health Literacy score (8 items)
HL-DIGI-INT	Digital Interaction Literacy score (2 items)
HL-VAC	Vaccination Health Literacy score (4 items, which all are included in the HLS_{19}-Q47 as well)

Following the method for calculating the GEN-HL score described above, these scores are also calculated as the percentage (ranging from 0 to 100) of items with valid responses that were answered with “very easy” or “easy” given that at least 80% of the items contained valid responses. The scores for the specific health literacy measures are explained in detail in the relevant chapters.

Categorical levels for the HLS_{19}-Q12

To visualize the distribution of health literacy within populations by percentages, it is common practice for many HL measures to also define categorical levels of health literacy. This was the case for the HLS-EU measures as well, and countries that had already used these were interested in having such a measure for the HLS_{19} too. Therefore, categorical levels for General HL, as measured by the HLS_{19}-Q12, are provided but not for the new specific HL measures. It was decided to use four categorical levels, as in the HLS-EU, and in accordance with the four response categories offered. Since the calculation of health literacy scores in the HLS_{19} (which is based on dichotomized items) deviates from the HLS-EU methodology, where a mean score of the polytomous items was used, the calculation of the levels had to be adapted. For the levels "excellent" and "inadequate" the percentage of items answered with "very easy" was used in addition to the score (i.e., percentage of items that were answered with "easy" or "very easy", or rather 100 minus the percentage of "difficult" or "very difficult"). Consequently, in some cases, respondents with equal scores are assigned to different levels. Another challenge with the definition of the four levels of health literacy described above is that in some cases, respondents who reported a higher health literacy level when using the original 4-point rating scale for all the HLS_{19}-Q12 items may be assigned to a lower categorical health literacy level than respondents who reported a lower level of health literacy based on the same rating scale.

For reasons of comparability and easier comprehensibility, the category labels used in the HLS-EU were retained. These normative labels are defined in a transparent way following a simple ruleset, namely that these labels should be easy to understand and suggest an intuitive ranking of lower or higher levels of health literacy. The level of "inadequate", for example, should be used to describe people for whom most of tasks included in the HLS_{19}-Q12 were "difficult" or "very difficult", with one task at the most being "very easy".

The following definitions of cut-off points[3] for the categorial levels of the HLS_{19}-Q12 were used (as far as possible based on the HLS-EU study):

» **Excellent**: "very easy" ≥ 50 AND "very difficult" + "difficult" < 8.334
  For "excellent", the number of answers with "very easy" should be above $^1/_2$ and the answers for "very difficult" + "difficult" should be no more than $^1/_{12}$.
» **Sufficient**: "very easy" + "easy" > 83.33
  For a level of "sufficient" health literacy, at least 10 out of the 12 items should be answered with "very easy" or "easy" and not more than 2 out of 12 with "very difficult" or "difficult".
» **Problematic**: all respondents who are not in the groups "excellent", "sufficient", or "inadequate" (i.e., once the three other categories have been calculated)
  The level of "problematic" is the intersecting set of not "excellent", not "sufficient" and not "inadequate".
» **Inadequate**: "very easy" < 8.334, "very difficult" AND "difficult" ≥ 50
  For "inadequate", the number of answers with "very difficult" + "difficult" should be above $^1/_2$ and for "very easy" should be no more than $^1/_{12}$.

Of course, categories for the HLS_{19}-47 or HLS_{19}-Q16 can be calculated with similar threshold values.

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[3] Identical cut-offs are used for all data collection methods.

4.3 Weighting of data for analyses

Unless otherwise stated, post-stratification weights were applied to the univariate, bivariate, and regression analyses described below. The base weights were calculated by the national teams and differ depending on the survey procedure (cf. Table 2.18 to Table 2.21, Subsection 2.4.4).

For country-by-country analyses, the effective weights are scaled so that their sum equals the number of valid cases in a country dataset. For analyses across all participating countries, the weights are rescaled so that the sum of weights by country equals 1,000, i.e., the countries have equal weights.

4.4 Univariate statistics

To present the results for individual items on the HL scales, two procedures are used. The percentages for the four response categories as well as for missing and total *n* for each item per country are shown in the annexes to the chapters concerned. In the chapters themselves, for easier comparisons across countries, the percentages for the dichotomized items are visualized as line charts to display variations in the ranking of task difficulty between countries and are presented in tables (e.g., Table 5.1).

Categorical data is described by the relative distribution of its levels (as percentages). Unless otherwise stated, the percentages are calculated based on the number of valid values. The percentage of missing values and the number of total respondents are reported separately.

The scores of HL measures were calculated based on dichotomized answer categories. To compensate for the resulting loss of information, item sets of categorical variables are also described by the average percentage response patterns (APRP), or the average percentage of how often a response category was selected within an item set. Given a data matrix consisting of *m* categorical items with *k* identical response categories for *n* respondents, an APRP is a compositional measure consisting of *k* percentages that describe for each of the *k* response categories how often the *n* respondents selected the respective category on average when answering the *m* categorical items. The APRP can be calculated as the average of the percentages of how often each category was selected for all items by each respondent. It can be calculated as follows:

» for each response category, count how often the category was selected for each respondent.
» for each item set, count how many valid answers were given by each respondent.
» for each response category, calculate how often a category was selected on average.
» for each response category, scale these mean values to the percentage of valid responses.
» for all response categories, summarize the mean percentages of valid responses in a table.

These APRP give convenient aggregate (or rather compositional) measures for a set of categorial items with identical response categories by using the information from all response categories.

They allow researchers and readers to:

- get a quick overview of how often response categories for variables in an item set were selected on average (and to identify potential problems with unused response categories and resulting problems with data quality),
- easily compare the use of response categories across different (sub)populations, and
- easily compare use of response categories across different item sets.

Quantitative data are described by their mean, median, and standard deviation. If appropriate, the quartiles are specified in addition. These tables are either placed in the chapter or in its annex (e.g., Table A 5.33).

In most tables, a reference value (across all countries, equally weighted) is provided to allow for an easier identification of trends across countries. Depending on the context, this value is called "All" in Figures or "Mean" in Tables and is referred to using "on average" in descriptions.

In general, confidence intervals are not provided for point estimates or associations in this report because this would greatly reduce the readability of tables and figures which include 17 countries. Due to the relatively large sample sizes, the confidence intervals would be very small and not very informative.

4.5 Bivariate associations

Associations between two variables, either of HL measures with a correlate variable or between correlate variables, were described by correlation coefficients and partly displayed graphically in line charts to determine the linearity of the association. For associations between a categorical variable and a quantitative one, line charts were used to compare across groups. Line charts allow readers to easily discern patterns and common trends across countries. This visualization method was chosen for clarity in the report, particularly about displaying the results for many countries in the same figure. Each country was represented by the same color and line pattern in all figures throughout this report.

The strength of the association between an ordinal variable and a quantitative one or between two ordinal variables was estimated using Spearman correlation coefficients (ρ). The association between quantitative variables was estimated using Pearson correlation coefficients (r). If the distribution of a quantitative variable was heavily skewed, the non-parametric Spearman ρ was used instead.

The association between a categorical and a quantitative variable was measured using the correlation ratio (η). In the case of a linear relationship for a dichotomous variable (e.g., gender), η is equivalent to the Pearson correlation coefficient (point biserial). Again, if the distribution of a quantitative variable was heavily skewed, the non-parametric Spearman ρ was used instead.

In general, confidence intervals were not provided for point estimates or associations in this report because this would greatly reduce the readability of tables and figures including up to 17 countries. Tests for statistical significance or p-values are not provided for the correlation tables but due to the relatively large sample sizes, the relevant values of coefficients will most probably be significant. Statistical significance (as $p < 0.01$) was highlighted in regression models for ß coefficient tables (cf. Section 4.6).

4.5.1 Identification of vulnerable or disadvantaged groups

Based on a similar procedure applied in the HLS-EU study, a set of potentially vulnerable or disadvantaged groups was defined and investigated using selected categories from seven variables. Four socio-demographic or socio-economic indicators and three health or sickness behavior related indicators were selected:

» advanced age (> 76 years old),
» low education (ISCED code ≤ 1 on a scale from 0 to 8),
» low level in society/low social status (≤ 4 on a scale from 1 to 10),
» financial deprivation (≥ 50%, i.e., considerable, or severe financial deprivation),
» "very bad" or "bad" self-perceived health,
» one or more long-term illnesses or health problems,
» a high number of contacts with a GP/family doctor (≥ 6) within the last 12 months.

In contrast to the HLS-EU, the deviation of the mean score per group with respect to the surveyed population is summarized in a table including the following information:

» the mean and standard deviation of the health literacy score concerned and the number of respondents, for each country, and the mean for all countries;
» for each defined vulnerable group, the difference in the mean value of the health literacy score from the overall country mean, and the number of respondents, for each country and the mean for all countries.

4.6 Regression analyses

Regression analyses were used to answer the following two research questions:

1. to determine a social gradient of HL measures and to measure the relative strength of the effects of the independent variables included, and
2. to check if there is an independent or direct effect of HL measures on selected potential consequences of HL when potential confounders are controlled for.

The main goal of the regression analyses was to be as simple as possible when answering these research questions and to facilitate the interpretation of the results by readers. More detailed and complex analyses will be the subject of supplementary scientific articles on selected topics.

Two types of linear models were applied for this report:

1. a multivariable linear regression model with all variables being entered as quantitative data (reported in the relevant chapters) and
2. a multivariable linear regression model with categorical variables encoded as dummy variables (provided in the annex of the chapters concerned).

The main text in the chapters covers the results for the regression models (β coefficients, R^2, the total, and the valid numbers of observations) with all variables being entered as quantitative data. Standardized β coefficients are also given for binary variables like gender. The unstandardized coefficients and the results for the regression models with categorical variables encoded as dummy variables can be found in the annexes but not in the main text.

Regression coefficients with a p-value of 0.01 or smaller are highlighted in bold. Given the large sample size of the surveys and the large number of statistical tests being calculated, a threshold (significance level) of 0.01 was used instead of the traditional 0.05. It should be noted that a proper adjustment for multiple testing (e.g., the Bonferroni correction) would yield an even lower threshold. The p-values and the highlighting of coefficients with p-values of 0.01 or lower should be seen as heuristics to identify potentially differing coefficients (Goodman et al. 2019; Krueger/Heck 2019).

The regression models were computed using the survey package (Lumley 2011) for R (R Core Team 2020a) to account for the complex sample design. For the models with all variables being entered as quantitative data, standardized and unstandardized coefficients were computed. Only unstandardized coefficients were computed for regression models with categorical variables encoded as dummy variables since the coefficients of dummy variables cannot be standardized. R^2 is provided as a measure of the variance explained by the regression model.

When the GEN-HL score is used as an outcome variable, the score (ranging from 0 to 100) was entered as a continuous variable. Following the HL research tradition and the HLS-EU, HL measures are treated as a gradient and not as a threshold affecting health (e.g., Wolf et al. 2010). Since the GEN-HL score distribution is skewed for most countries, the use of a transformed score was also investigated. Since this did not improve model performance but complicated the interpretation of the regression parameter estimates, it was decided not to use any transformation procedure.

The outcome variables are generally interpreted as continuous, and simple linear regression models are calculated. The dichotomization of outcome variables to calculate logistic regression models was only used in the chapter on Vaccination HL where a dichotomous variable had been collected for vaccination behavior. It should be noted that certain formal assumptions of linear regression models, such as normally distributed residuals, may not be met in all the models presented in this report. This could be especially true for the assumption of linearity for models when formally ordinal variables were entered as interval-scaled outcome variables since it cannot be guaranteed that the true distances between the response categories are perfectly equally spaced on a theoretical underlying continuum. However, there are numerous studies, particularly for self-perceived health in health reporting and health literacy research, in which exactly this approach is used, so this study fits into a long-standing research practice with this approach. For self-perceived health, for example, (Griebler 2017) states (authors' translation): "[S]elf-rated health is treated as a continuous variable (Perruccio et al. 2010). It functions as a proxy for the underlying measurement continuum (Jürges 2007; Leinonen et al. 2002) – a quite common method for ordinal scaled variables with five or more expressions (Johnson/Creech 1983; Zumbo/Zimmermann 1993)". In addition, respondents are often quite capable of reproducing their true attitudes given on a continuous rating scale in more coarse 5- or 7-point Likert-style response formats (Carifio/Perla 2007). While the uniformity of the analyses and, thus, the use of linear regression models was important for the present International Report, for more detailed analyses and national reports, the use of regression models better suited for ordinal outcome variables could be considered. The formal assumption of homoscedasticity is most likely not met when applying a simple linear regression model to count data as outcome variables. This results in the models have a suboptimal model fit (measured as R^2), which is not a major problem since in research question 2, the only interest is in testing an effect of the HL measure(s). The suboptimal fit should only have low impact on the relative importance of the predictor variables, though, which was verified for some models. In the national reports and in more detailed analyses in follow-up scientific publications, the use of regression models better suited for count data in outcome variables should be considered.

Based on the existing literature, a core set of the following five socio-demographic and socio-economic predictors and, in some models, three additional predictors were tested for their association with health literacy scores and with various other outcome variables, such as indicators of healthy lifestyles, personal health, and the use of health care services. These outcome variables, which are also referred to as the potential "consequences" of HL, are introduced and described in detail in Chapters 7, 8, and 9 respectively as well as in Chapter 12 (Digital Health Literacy) and 13 (Vaccination Health Literacy).

Core socio-demographic and socio-economic predictors (in short, the core social determinants of HL) are:

» gender,
» age,
» education,
» self-perceived level in society,
» financial deprivation/difficulties.

Additional predictors:

» migration background,
» long-term illnesses/health problems,
» training in a healthcare profession.

In the present report, all variables are entered in the models simultaneously. More detailed analyses, possibly including path models and more elaborate regression models, will be covered in dedicated publications on selected topics.

An important requirement for selecting a variable as a predictor is its fair measurement and interpretability across all countries. This requirement cannot be assumed in the case of migration due to the wide range of migration situations, policies, and activities in individual countries. In addition, surveys in the languages of larger migrant groups only took place in Israel as well as in specific additional studies in Germany and Norway. The HLS_{19} surveys also differ significantly concerning the extent and representativeness (e.g., in education) of the respondents with migration backgrounds. For this reason, special attention should be paid when interpreting the migration coefficients from an international perspective.

In the surveys, age was recorded as years since birth, which was recoded to an ordinal variable with seven levels. However, in the models, with all variables being entered as quantitative data, age in years was used. The idea of entering age in years as an additional quadratic term was also investigated, but this option was abandoned due to inconsistent and difficult-to-interpret results. In the regression models with categorical variables encoded as dummy variables, age was, therefor, entered as an ordinal variable, allowing a better handling of non-linear relationships with the outcome variable. To better capture the various non-linear relationships formed between age and health literacy, the use of these latter models is preferred for investigating this specific association in detail.

Education was surveyed using the ISCED 2011 scale (Schneider 2013; UNECSCO 2012). The actual implementation varied from country to country to accommodate different national education systems. The ISCED classification was used because it provides a roughly comparable classification across the whole range of possible education levels, including tertiary education, for almost all countries worldwide. The ISCED classification is often used in similar research and thus facilitates the comparison of results. For better international comparability, the ISCED codes were recoded to four levels:

3. lower secondary education or below (up to ISCED-2),
4. higher secondary education (ISCED-3),
5. post-secondary or short-cycle tertiary education (ISCED-4 and 5),
6. bachelor or higher (ISCED-6 to 8).

This four-level variable was used for tables, figures, and the regression models with categorical variables encoded as dummy variables (see above). For the regression models and the calculation of correlation coefficients presented in the main text, the raw ISCED 2011 code was entered as a continuous variable. Due to differences in the sampling and data collection procedures, it may be assumed that the coverage of people with lower levels of education differs across the various HLS_{19} surveys. This could possibly explain inconsistent results in the regression analyses with respect to education across countries.

For the variable self-perceived level in society, the extreme categories (1+2 and 9+10) were combined in some analyses to overcome potential low frequency effects in these categories. For the regression analyses presented in the main text, this variable was entered as a continuous predictor.

For the item set financial deprivation, a summary score of the following three items with the response categories “very easy”, “easy”, “difficult”, and “very difficult” was calculated:

» C-DET9 How easy or difficult is it usually for you to afford medication, if needed?
» C-DET10 How easy or difficult is it usually for you to afford medical examinations and treatments, if needed?
» C-DET11 How easy or difficult is it for you to pay all bills at the end of the month?

In line with the described calculation method of the GEN-HL score, the financial deprivation scores were calculated as percentages (ranging from 0 to 100) for items with valid responses that were answered with “very difficult” or “difficult”. The values of the financial deprivation score were assigned the following labels:

» 0=none,
» 33.33=some,
» 66.67=considerable,
» 100=severe.

This method simplifies the more elaborate method used in the HLS-EU study based on a principal component analysis for each country. Since these two methods produce very highly correlated scores, it was assumed that this extra step does not provide sufficient benefit to justify this additional complexity.

Migration is only included as a predictor in selected models such as determinants of health literacy (Chapter 6), health care utilization as a consequence of General Health Literacy (Chapter 9), and Digital Health Literacy (Chapter 11). A 4-point ordinal variable was used for a migration background with the following levels: “none”, “one parent was born abroad”, “both parents were born abroad”, “born abroad”.

Long-term illness is only included as a predictor in selected models such as determinants of health literacy (Chapter 6), health care utilization as a consequence of General Health Literacy (Chapter 9), and Digital Health Literacy (Chapter 11). The number of long-term illnesses or health problems was entered as an ordinal variable with the levels “none”, “one”, or “more than one”; for one country (Slovenia), “one or more” was used instead of the last two categories.

Training in a health profession is, in general, not considered a social determinant of health literacy. Since it is potentially an important confounder, some regression models investigated its influence on health literacy (in Chapter 6 and 10 to 14). Training in a health profession was entered as a dichotomous yes/no variable into the regression models.

While some of the mentioned variables are weakly or moderately correlated, as shown in the relevant chapters, the absolute Spearman ρ is generally below 0.4, so collinearity should be a minor problem.

Stepwise regressions are not recommended since they lead to biased model fit estimates or p-values (Heinze/Dunkler 2017). Even when applying stepwise regression, only full-model fits give unbiased estimates. While a feature selection procedure can be helpful for data mining or machine learning tasks, it is of limited use in the context of social science when each predictor is derived from theoretical considerations or the established results of existing research. Another argument against using stepwise regression in this International Report is that it could result in different models for different countries, while we aimed at consistent models for all participating countries.

4.7 Validity analyses

In general, we follow the argumentation of (Osborne et al. 2021) that an instrument cannot be validated as such but only for a specific survey sample. This is all the more true, when the instrument is used in different languages. Therefore, we validated each survey or country separately. Further uses of the instruments in follow-up studies will require their own validation analyses.

The construct validity of the instrument is ensured by selecting the best-fitting item for each cell in the theoretically founded health literacy matrix and by applying appropriate statistical analyses. In detail, the HLS_{19}-Q12 (and, if appropriate, also the specific health literacy measures) was validated by Cronbach's alpha for reliability, confirmatory factor analysis (CFA), by Rasch analyses for unidimensionality, by correlations for the representativeness of the HLS_{19}-Q12 of the long form HLS_{19}-Q47. With respect to concurrent convergent validity, the results of the chapters on the expected consequences of HL (Chapters 7 to 9) will provide additional evidence for the measure of General HL and the individual chapters for specific aspects of HL.

The various surveys in the HLS_{19} study vary in methodology and in the language(s) used. Testing the effects of the survey methodology is beyond the scope of the present study since an analysis of such effects would require a specific research design. Item-score correlations, another popular method to assess the psychometric quality of a measurement instrument, are provided for General HL in Annex 5 (Chapter A 5.3).

4.7.1 Cronbach's alphas

The internal consistency of a set of items was assessed using the Cronbach alpha coefficient (Cronbach 1951). In the literature, a minimum value of 0.7 is recommended (Kline 2015). Lower values may be acceptable since the coefficient is sensitive to the number of items included and other circumstantial parameters. When calculating alpha coefficients using dichotomized variables, the value is expected to be lower than when using polytomous variables.

The alpha coefficients in Chapters 5 and 10 to 13 are calculated based on the dichotomized items because the scores are also derived from dichotomized items. An alpha coefficient based on tetrachoric correlations would yield higher values. Given the heavily skewed distributions, it was expected that the tetrachoric correlations would overestimate the strength of the associations. An ordinal alpha coefficient based on the polytomous items would yield higher values too. The

Cronbach alpha coefficients, based on the Pearson correlation of the dichotomized items, thus represent a lower bound of possible alpha coefficients.

4.7.2 Confirmatory factor analyses

One way to assess the single-factor structure of an item set based on Classical Test Theory is confirmatory factor analysis [CFA]. The model consists of the dichotomized items loading onto a single latent variable. The CFA is conducted using the lavaan package (Roussel 2012) for R (R Core Team 2020a). A WLSMV estimator with diagonally weighted least squares (DWLS) for model parameters is used (Beaujean 2014; Kline 2015; Rosseel 2021). The focus lies on whether the fit indices suggest a sufficiently good model fit that indicates a single data-generating process generated the data. Since various fit indices have different advantages and disadvantages (Prudon 2015), a set of the six most commonly used fit indices is calculated.

The following target values are assumed as indications of a good fit:

» Standardized Root Mean Square Residual [SRMSR] ≤ 0.08 (Prudon 2015)
This directly compares the sample correlation matrix with the implied correlation matrix.
» Root Mean Square Error of Approximation [RMSEA] ≤ 0.06 (Prudon 2015)
The RMSEA builds on the X^2 test but penalizes free parameters.
» Tucker-Lewis Index [TLI] ≥ 0.95 (Prudon 2015)
This compares the X^2 of the implied matrix to that of the null model.
» Comparative Fit Index [CFI] ≥ 0.95 (Prudon 2015)
This compares the X^2 of the implied matrix to that of the null model but penalizes free parameters.
» Goodness of Fit Index [GFI] ≥ 0.95 (Beaujean 2014)
This compares the model of interest to a null model and can be interpreted similarly to R^2 in regressions.
» Adjusted Goodness of Fit Index [AGFI] ≥ 0.9 (Beaujean 2014)
Like the GFI but it penalizes free parameters.

4.7.3 Rasch analyses

The psychometric properties of the HLS_{19}-Q12 and the newly developed instruments applied in the chapters about specific types of health literacy (cf. Chapters 10 to 14) were tested against the partial credit parameterization of the polytomous unidimensional Rasch model (Masters 1982; Rasch 1960). By testing data against Rasch models, we assess whether observed data sufficiently meet the expectations of the theoretical Rasch model. The validity of instruments that intend to measure latent traits or characteristics, such as health literacy, is increased by including items that measure various aspects of the latent trait (Andrich/Marais 2019). However, to add scores from single items into a total score for a set of items or a scale, the data must be sufficiently unidimensional (Smith, 2002). The dimensionality of instruments applied in this report was assessed using the combined principal component analysis (PCA) of residuals and the paired *t*-test procedure (Smith 2002). We also assessed whether the content of pairs of items are too similar and collect the same or overlapping information. We refer to this as response dependence or statistically dependent items. Residual correlations between two items > 0.3 were used as possible indicators of response dependence. If a set of items is sufficiently unidimensional and no questions are statistically dependent, we can say that the instrument meets the assumption of local independence (Andrich/Marais 2019).

When testing data against Rasch models, we also assessed whether observed data sufficiently meet the expectations of the theoretical Rasch model. If an item captures too much of something other than what the item was intended to measure – that something other than health literacy affecting how the respondents answer – we refer to this as an under-discriminating item (Andrich/Marais 2019). By that we mean that the item does not manage to distinguish or discriminate sufficiently well between people with low and high health literacy. Item fit was assessed by examining χ^2 statistics and standardized residuals based on comparisons between observed and expected values. Items with low χ^2 values and χ^2 probability values higher than a Bonferroni-adjusted 5% were considered to have adequate fit. In addition, we used infit statistics to assess item fit. Infit < 1 indicates an over-discriminating or over-fitting item, and infit > 1 indicates an under-discriminating or under-fitting item. Infit values between 0.7–1.3 were considered to represent sufficient data-model fit.

We also tested whether the items worked in the same way for different groups of respondents, investigating, for example, whether gender significantly affected the respondents' answers to individual items. If factors such as age, gender, and education significantly influence the answers to a certain item, we refer to this as "DIF" (differential item functioning). The items were examined for DIF using the two-way analysis of variance (ANOVA) (Andrich/Marais 2019). In addition, we assessed whether the response categories on the 4-point rating scales worked as intended, in other words whether they are "ordered".

Table 4.1:
Levels of person factors used for the analysis of differential item functioning (DIF)

Person factor	Levels (categories)		
	1	2	3
Gender (CDET1)	male	female	
Age (CDET2)			
Dichotomized	18 to 45 years	46 years or older	
agecat1	18 to 25 years	26 to 65 years	66 years or older
agecat2	18 to 45 years	46 to 75 years	76 years or older
Education (CDET6)	ISCED 0–3	ISCED 4–8	
Employment (CDET7)	employed	unemployed or retired	
Paying bills (CDET11)	easy	difficult	
Social level (CDET12)	levels 1–4	levels 5–10	
General health (CHSTAT1)	good or fair	bad	

Source: HLS_{19} Consortium

4.7.4 Predictive validity

For the predictive validity of the general and specific HL measures, see the results in Chapters 7 to 9 on the potential consequences of the General HL measure and in Chapters 11 to 15 on optional packages for the specific HL measures.

4.7.5 Comparisons of the HLS_{19}-Q12 short form with the HLS19-Q16 and HLS19-Q47 long forms

Since the HLS_{19}-Q12 is a short form of the HLS_{19}-Q47 long form, another important criterion for its validation is how well the HLS_{19}-Q12, which uses just one item for each cell in the underlying theoretical HL matrix, represents the scores of the HLS_{19}-Q47. One criterion for this is the Pearson correlation of the HLS_{19}-Q12 short form with the HLS_{19}-Q47 long form. Since only six countries collected data for the HLS_{19}-Q47, this kind of empirical equivalence could only be tested for that subset of countries taking part in the HLS_{19}. A high Pearson correlation coefficient is an indication that the score of the Q12 short form can be used as a more economical substitute for the score of the Q47 long form.

4.8 Discussion and conclusions

We tried to standardize data analyses and presentations of the results for all chapters to allow comparisons between the different chapters and the participating countries. Due to the differences in data collection, comparisons between individual countries are, nevertheless, only possible to a limited degree and should be made with caution.

With respect to the HLS-EU predecessor study, several computational changes were adopted that, in addition to the differences in the questionnaire (cf. Chapter 2) and data collection (cf. Chapter 3), limit the comparability of its results with the HLS_{19}. Consequently, comparisons with results from the HLS-EU study were only included in the present report in the “Discussion” sections.

Most importantly, the response categories of the HL items were interpreted as ordinal scales and not interval scales, as was done in the HLS-EU and follow-up studies. This led to changes in the calculation of the score as the percentage of items being answered as “easy” or “very easy” (ranging from 0 to 100 instead of 0 to 50 as in the HLS-EU study). Hence the value of the HL score can easily be interpreted as the percentage of health-relevant tasks experienced as “easy” or “very easy”. To keep the definition of the four discrete levels of General HL based on the HLS_{19}-Q12 measure comparable with the HLS-EU, the calculation of the four levels of HL takes not only the score into account but also the proportions of responses in the extreme categories. Differences between the score described above and the scores following the HLS-EU method were examined but revealed only minor differences for key results.

Besides Cronbach’s alpha for internal consistency, CFA and Rasch analyses were administered for the General HL (HLS_{19}-Q12) and specific HL measures but not for the HLS_{19}-Q47 and HLS_{19}-Q16. These analyses demonstrated that the General HL scale in the HLS_{19}-Q12 is sufficiently unidimensional.

The predictive validity of the HL measures was investigated partly with the same indicators of correlates as in the HLS-EU, partly with somewhat modified indicators, and partly with indicators of additional correlates.

Some of the indicators for relevant correlates of HL were measured or constructed differently than in the HLS-EU, and indicators for additional correlates were included, which further limits comparability between the two studies but allowed for additional analyses.

For potential determinants and a social gradient of the HL measures, the same variables were used as in the HLS-EU with a few additional determinants. For bi-variate relations alongside Spearman correlations, figures showing the form of the relationship are provided. For testing direct independent effects, multivariable linear models were analyzed. In addition, multivariable linear models with the categorical variables encoded as dummy variables are provided in the annex. The same holds true for testing the potential consequences of HL measures.

With respect to the HLS-EU study, we conclude that the HLS_{19} instrument, the data analyses, and the presentation of results were improved, but these improvements limit the comparability with the HLS-EU results.

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5 The HLS$_{19}$-Q12 measure

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5.1 Distributions of the HLS_{19}-Q12 items

The distributions of the responses to individual items are summarized in two ways: (1) by percentages of those who responded with “very difficult” or “difficult” per item (cf. Table 5.1, Figure 5.1) and (2) by Average Percentage Response Patterns (APRP) for each country (cf. Figure 5.2). The frequency tables for each item by country are presented in Annex 5.1. The percentages of respondents who responded with “very difficult” or “difficult” to the HLS_{19}-Q16 and HLS_{19}-Q47 measures can be found in Annex 5.2.

The overall percentage of respondents ticking “very difficult” or “difficult” varies between 8.1% and 43.0% for the HLS_{19}-Q12 items (cf. Table 5.1) with item 4 “to act on advice from your doctor or pharmacist” being the easiest item and item 3 “to judge the advantages and disadvantages of different treatment options” being the most difficult. In general, the items in the HLS_{19}-Q12 were not rated as predominantly “very difficult” or “difficult”, with the sole exception of Germany, where the tasks referred to by items 3, 8, and 5 were reported as “very difficult” or “difficult” by 56.1% to 71.2% of the respondents.

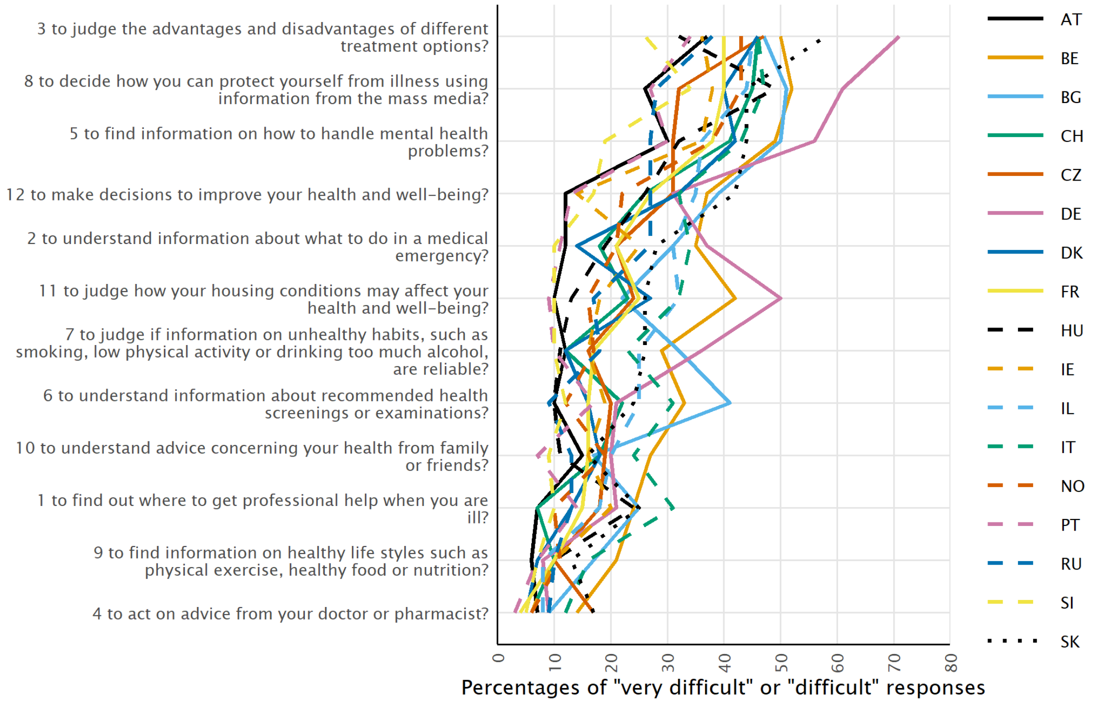
The item difficulties vary by country. The combined percentage of “very difficult” and “difficult” responses ranges from 25.6% (SI) to 71.2% (DE) for the most challenging item 3 “to judge the advantages and disadvantages of different treatment options”, and from 3.4% (PT) to 17.2% (CZ and SK) for the least difficult item 4 “to act on advice from your doctor or pharmacist”. Nevertheless, there is a more or less common ranking by difficulty of the tasks across countries (cf. Table 5.1 and Figure 5.1).

Table 5.1:
Percentages of respondents in each country who responded with “very difficult” or “difficult” to the HLS19-Q12 items (ordered by the mean for the row), for each country and the mean for all countries (equally weighted)

	AT	BE	BG	CH	CZ	DE	DK	FR	HU	IE	IL	IT	NO	PT	RU	SI	SK	Mean
3 … to judge the advantages and disadvantages of different treatment options?	36.9	49.9	46.7	46.3	46.9	71.2	45.5	39.9	32.0	35.6	45.1	46,5	43.2	33.5	38.3	25.6	58.4	43.0
8 … to decide how you can protect yourself from illness using information from the mass media?	25.9	51.9	51.0	44.9	31.8	61.3	39.7	40.5	49.3	38.3	43.5	47.0	43.3	26.8	27.6	34.2	43.5	39.7
5 … to find information on how to handle mental health problems?	30.5	48.6	50.2	40.8	31.4	56.1	42.1	37.9	32.5	36.4	35.5	43,2	37.8	29.9	27.2	19.1	44.1	36.1
12 … to make decisions to improve your health and well-being?	11.9	37.1	39.3	26.0	30.7	30.7	32.5	27.3	26.4	14.5	34.8	32.0	22.1	13.4	26.6	16.9	42.1	25.6
2 … to understand information about what to do in a medical emergency?	11.5	35.0	30.7	17.9	20.6	37.2	14.2	21.4	18.8	24.7	30.8	34,4	20.9	11.3	26.7	10.0	27.9	22.7
11 … to judge how your housing conditions may affect your health and well-being?	9.5	42.1	21.5	22.9	23.9	49.5	26.6	25.4	13.0	18.3	31.6	32.0	16.2	8.7	17.2	9.6	26.5	22.2
7 … to judge if information on unhealthy habits. such as smoking. low physical activity, or drinking too much alcohol. is reliable?	11.8	28.9	31.6	11.9	16.5	35.8	11.6	16.9	11.1	15.9	24.7	23,2	16.6	10.5	18.1	10.2	26.4	17.8
6 … to understand information about recommended health screenings or examinations?	10.2	32.7	40.8	21.5	20.5	21.0	15.6	16.4	9.7	19.2	24.8	30,6	12.0	17.1	9.3	11.8	23.7	17.2
10 … to understand advice concerning your health from family or friends?	14.8	26.9	17.0	18.2	18.6	20.0	18.5	16.1	11.3	16.2	19.7	24,1	18.7	6.6	12.8	9.2	16.1	16.5
1 … to find out where to get professional help when you are ill?	7.3	23.6	25.3	7.4	17.9	20.7	12.8	15.4	23.8	20.4	18.3	31.0	9.7	13.8	12.7	9.7	24.8	16.2
9 … to find information on healthy lifestyles such as physical exercise. healthy food, or nutrition?	6.1	20.7	16.9	10.2	9.6	8.3	7.2	9.8	9.7	10.0	7.8	16,4	11.0	7.1	9.7	7.0	13.1	9.9
4 … to act on advice from your doctor or pharmacist?	7.3	13.7	9.1	5.9	17.2	9.0	5.4	3.6	6.5	5.9	7.9	11,7	5.6	3.4	9.1	4.8	17.2	8.1
Mean	15.3	34.3	31.7	22.8	23.8	35.1	22.6	22.6	20.3	21.3	27.0	31	21.4	15.2	19.6	14.0	30.3	22.9

Source: HLS19 Consortium

Figure 5.1:
Percentages of respondents who responded with “very difficult” or “difficult” to the HLS$_{19}$-Q12 items (ordered by the overall mean), for each country

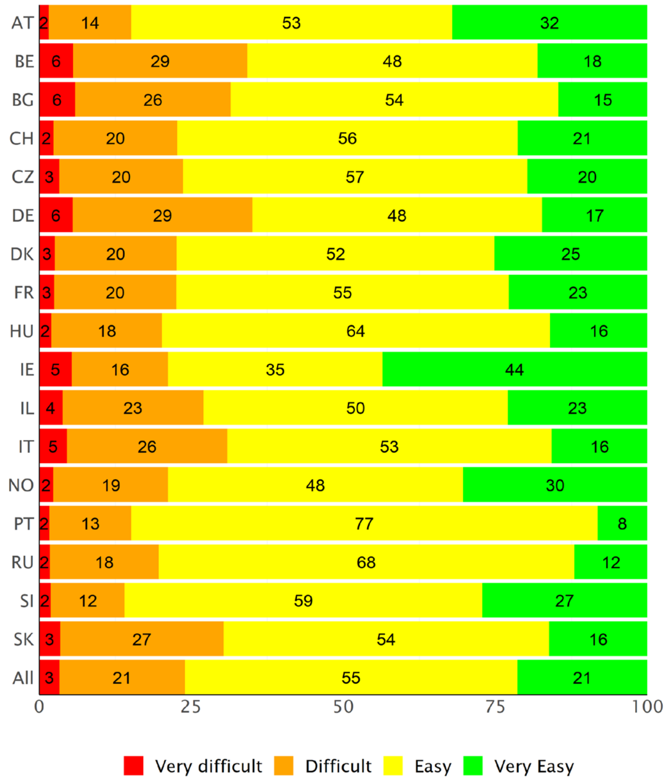


Source: HLS$_{19}$ Consortium

5.2 Average Percentage Response Patterns (APRP)

Average Percentage Response Patterns (cf. Section 4.4) are calculated to represent a summary of a set of categorical variables (cf. Figure 5.2). In almost all countries, people most often responded to the HLS$_{19}$-Q12 items with “easy”. Overall, 55% of the respondents answered with “easy” (with the country average ranging from 35% (IE) to 77% (PT)) and 21% with “very easy” (from 8% (PT) to 44% (IE)). Another 21% answered with “difficult” (from 12% (SI) to 29% (BE and DE)) and only 3% with “very difficult” (2% for AT, CH, HU, NO, PT, RU, SI to 6% for DE) (Figure 5.2). Thus, the items included in the HLS$_{19}$-Q12 questionnaire are, on average, rather easy and therefore the measure is more sensitive for lower grades of HL than for higher ones.

Figure 5.2:
Average Percentage Response Patterns (APRP) for the HLS19-Q12 item set, for each country and the mean for all countries (equally weighted)



Source: HLS19 Consortium

5.3 Internal consistency of the HLS19-Q12

The internal consistency or "test reliability" of the HLS19-Q12, which is also a measure of the scale's ability to distinguish between respondents with different sum scores, was estimated using Cronbach's alpha (cf. Subsection 4.7.1). In the literature, a minimum value of 0.7 is recommended (Kline 2015).

The values range from 0.67 (AT) to 0.87 (PT). Except for Austria, the values are above the target value of 0.7 (in Table 5.2). The internal consistency, thus, is acceptable for the given data of most countries. For each country, the inter-item (Annex Tables A 5.15 to A 5.31) and the item-score Spearman correlation coefficients (Table A 5.32) are available in Annexes 5.3 and 5.4.

Table 5.2:
Cronbach's alpha for the HLS_{19}-Q12, for each country and the mean for all countries (equally weighted)

	AT	BE	BG	CH	CZ	DE	DK	FR	HU	IE	IL	IT	NO	PT	RU	SI	SK	Mean
Cronbach's alpha	0.67	0.82	0.78	0.72	0.78	0.73	0.75	0.81	0.76	0.72	0.80	0.85	0.73	0.87	0.86	0.82	0.81	0.78

Source: HLS_{19} Consortium

5.4 Results of Confirmative Factor Analyses for the HLS_{19}-Q12

A confirmatory factor model with the twelve dichotomized HLS_{19}-Q12 items loading onto a single factor was estimated (see Subsection 4.8.2). Since various fit indices have different advantages and disadvantages (Prudon 2015), the six most commonly used goodness-of-fit measures were calculated.

The following target values are assumed as indications of a good model fit:

» Standardized Root Mean Square Residual [SRMSR] ≤ 0.08 (Prudon 2015)
» Root Mean Square Error of Approximation [RMSEA] ≤ 0.06 (Prudon 2015)
» Comparative Fit Index [CFI] ≥ 0.95 (Prudon 2015)
» Tucker-Lewis Index [TLI] ≥ 0.95 (Prudon 2015)
» Goodness of Fit Index [GFI] ≥ 0.95 (Beaujean 2014)
» Adjusted Goodness of Fit Index [AGFI] ≥ 0.9 (Beaujean 2014)

The fit indices indicate a good model fit, which means that the single factor confirmatory model accounts sufficiently well for the correlation patterns among the HLS_{19}-Q12 items (cf. Table 5.3).

The items for which the standardized parameter estimates (cf. Table 5-4) differ the most across countries are (range ≥ 0.4):

» item 4 "to act on advice from your doctor or pharmacist"
» item 9 "to find information on healthy lifestyles such as physical exercise, healthy food, or nutrition"
» item 10 "to understand advice concerning your health from family or friends"

As these are also among the easiest items (cf. Figure 5.1), this could cause these discrepancies in the loadings.

Table 5.3:
Fit indices for the CFA for the HLS_{19}-Q12, for each country and the mean for all countries (equally weighted)

	AT	BE	BG	CH	CZ	DE	DK	FR	HU	IE	IL	IT	NO	PT	RU	SI	SK	Mean
SRMSR	0.07	0.08	0.07	0.07	0.05	0.07	0.06	0.05	0.07	0.06	0.06	0.05	0.07	0.05	0.05	0.04	0.06	0.06
RMSEA	0.03	0.05	0.04	0.03	0.03	0.04	0.03	0.02	0.03	0.03	0.03	0.04	0.04	0.02	0.04	0.02	0.04	0.03
CFI	0.97	0.98	0.99	0.98	0.99	0.97	0.98	1.00	0.98	0.97	0.99	0.99	0.97	1.00	0.99	1.00	0.99	0.98
TLI	0.96	0.97	0.98	0.97	0.99	0.96	0.98	0.99	0.98	0.96	0.99	0.99	0.96	1.00	0.99	1.00	0.98	0.98
GFI	0.99	0.98	0.98	0.99	0.99	0.98	0.99	0.99	0.99	0.99	0.99	0.99	0.99	1.00	0.99	1.00	0.99	0.99
AGFI	0.99	0.97	0.97	0.98	0.98	0.97	0.99	0.99	0.98	0.98	0.99	0.99	0.98	0.99	0.99	1.00	0.98	0.98

AGFI=Adjusted Goodness of Fit Index; CFI=Comparative Fit Index; GFI=Goodness of Fit Index; RMSEA=Root Mean Square Error of Approximation; SRMR=Standardized Root Mean Square Residual; TLI=Tucker-Lewis Index

Source: HLS_{19} Consortium

Table 5.4:
Standardized parameter estimates for the HLS19-Q12 score in a single-factor CFA, for each country and the mean for all countries (equally weighted)

Item no.	AT	BE	BG	CH	CZ	DE	DK	FR	HU	IE	IL	IT	NO	PT	RU	SI	SK	Mean
1	0.58	0.72	0.63	0.51	0.70	0.56	0.64	0.55	0.58	0.57	0.61	0.69	0.59	0.79	0.73	0.70	0.72	0.64
2	0.54	0.63	0.64	0.64	0.68	0.60	0.64	0.66	0.69	0.55	0.67	0.79	0.58	0.73	0.78	0.78	0.73	0.67
3	0.61	0.67	0.74	0.63	0.67	0.67	0.72	0.71	0.65	0.55	0.71	0.73	0.59	0.70	0.81	0.68	0.69	0.68
4	0.44	0.76	0.74	0.52	0.57	0.53	0.59	0.55	0.65	0.62	0.58	0.67	0.70	0.85	0.74	0.79	0.59	0.64
5	0.63	0.65	0.72	0.72	0.64	0.65	0.69	0.78	0.56	0.59	0.72	0.71	0.61	0.77	0.78	0.80	0.73	0.69
6	0.58	0.70	0.35	0.59	0.67	0.61	0.66	0.71	0.78	0.70	0.74	0.78	0.68	0.83	0.78	0.72	0.68	0.68
7	0.53	0.73	0.75	0.61	0.64	0.65	0.63	0.75	0.67	0.66	0.69	0.77	0.65	0.86	0.81	0.82	0.66	0.70
8	0.63	0.59	0.65	0.53	0.69	0.63	0.64	0.77	0.52	0.46	0.75	0.71	0.50	0.82	0.79	0.58	0.65	0.64
9	0.62	0.78	0.77	0.66	0.62	0.72	0.68	0.70	0.73	0.64	0.59	0.73	0.60	0.99	0.82	0.85	0.80	0.72
10	0.46	0.62	0.65	0.43	0.55	0.37	0.50	0.58	0.62	0.59	0.60	0.67	0.60	0.81	0.68	0.66	0.60	0.59
11	0.59	0.67	0.61	0.62	0.70	0.54	0.63	0.76	0.73	0.56	0.62	0.74	0.53	0.87	0.76	0.77	0.63	0.67
12	0.54	0.69	0.57	0.65	0.58	0.53	0.56	0.73	0.59	0.56	0.67	0.71	0.54	0.69	0.73	0.64	0.65	0.63

Source: HLS19 Consortium

5.5 Rasch analyses

When testing data against the Partial Credit Model (PCM) (Masters 1982) for each country, the HLS_{19}-Q12 displays good overall data-model fit in Austria (CATI), Denmark, Germany, Israel (CAWI), Italy (CAWI), Norway, Slovakia, and Switzerland (Table 5.5). Reducing the sample size to $n=360$ (12 items $\times$ 3 thresholds $\times$ 10 persons per threshold) means that the HLS_{19}-Q12 displays acceptable overall data-model fit also in France, Hungary, Russia, and Slovenia. The HLS_{19}-Q12 has an acceptable reliability index in each country (Table 5.5).

The HLS_{19}-Q12 was somewhat "off target" as the items refer to tasks most people perceive as manageable. The HLS_{19}-Q12 was best targeted to the Belgian and German populations, as the distributions of item difficulties matched the distribution of person proficiencies quite well.

The HLS_{19}-Q12 items measure three health domains (health care, health promotion, and disease prevention) and four cognitive domains (find, appraise, understand, and apply). These different domains or aspects capture the complexity of the construct and increase the content validity of the HLS_{19}-Q12 scale, but they inevitably bring multidimensionality into the measure. Using a principal component analysis of Rasch model residuals, two possible subscales or item subsets of the HLS_{19}-Q12 were identified empirically. Each respondent's proficiency estimates, based on those two subsets of items, were compared and the difference was tested using a dependent *t*-test. Table 5.5 shows that the percentage of significant dependent *t*-tests are close to or below 10% for each country (the column "Dim (%)"), varying between approximately 11% (BG, CAWI) and 5.5% (NO). This means that relatively low proportions of respondents were assigned statistically significant different proficiency estimates based on the two empirically identified item subsets. The two subsets therefore seem to measure "the same", and we may conclude that the HLS_{19}-Q12 is sufficiently unidimensional and measuring one latent trait referred to as HL.

No evidence of response dependency or "too similar" items was observed, meaning that no pair of items shared variance over and beyond the latent trait "health literacy".

Most HLS_{19}-Q12 items displayed acceptable data-model fit. However, item 8 "to decide how you can protect yourself from illness using information from the mass media" discriminated somewhat poorly between respondents with high and low HL (z-fit > 3.0 and/or infit > 1.2) in several countries (AT, BE, CH, HU, IE, NO, and SI). The response categories of the HLS_{19}-Q12 items were ordered and worked well, but item 4 "to act on advice from your doctor or pharmacist" displayed possibly unordered thresholds in the BE, IE, and NO data (but was not significant in the NO data).

Several items displayed differential item functioning (DIF) even when sample size was reduced to 1,080, where the amended sample size of 1,080 is estimated as, using a "rule of thumb", the product of 30 respondents per 3 item thresholds for 12 items (see Table A2 in the Technical report in (Guttersrud et al. 2021). For some items, DIF was still evident when reducing the sample size to 720, where the amended sample size of 720 is estimated as the product of 20 respondents per

3 item thresholds for 12 items. One example is item 6 "to understand information about recommended health screenings or examinations", which displayed DIF for employment in some countries (BE, FR, and SI) as well as for respondent age in several countries (BE, CH, CZ, DK, FR, and SI). The interpretation is that, despite the same level of health literacy, older respondents tend to respond more often to item 6 with "easy" or "very easy" than younger respondents do. Young people may be less familiar with health screenings and have a poorer understanding of information about these examinations. Unemployed or retired people, who possibly have health problems more often and therefore may be more exposed to this type of information, respond to item 6 with "easy" or "very easy" more often than employed respondents.

As the HLS_{19}-Q12 measures health literacy in 17 countries, the items were translated into several languages and applied in the context of different health systems. If some countries offer different health screenings and/or concepts like "recommended" and/or "examination" are translated, interpreted, or understood differently in different countries, people will respond differently depending on their country of residence. Therefore, people with the same level of health literacy may respond differently to a specific item depending on their country of origin. We refer to this as "differential item functioning" (DIF). Items displaying DIF for the variable "country" indicate that these items measure differently across countries and that comparative analyses are invalid. Item revisions based on HLS_{19} data may make comparative analyses possible in future studies. The conclusion was that the HLS_{19}-Q12 data seem to have acceptable quality *within* countries but that comparative analyses *between* countries may have to be avoided.

Table 5.5:
Overall analyses for the HLS_{19}-Q12, for each country and data collection method or "mode"

Country	χ^2, *p*	Mode	Mean[g]	Reliability		Dim (%)
				α	*PSI*	
Austria	72.1, .82	CATI	1.55[h]	.84	.82	7.5
Austria[a]	115.5, .01*	CAWI	1.06[h]	.86	.85	10.1
Belgium	109.4, .03*	CAWI	.62	.88	.88	7.7
Bulgaria[e2]	141.2, .00**	CAPI	.70	.81	.79	6.7
Bulgaria[e2]	238.2, .00**	CAWI	.90	.85	.83	11.0
Czech Republic[b]	110.3, .03*	CATI	1.12[h]	.82	.79	7.0
Czech Republic	112.8, .02*	CAWI	.83[h]	.84	.84	6.4
Denmark	79.9, .61	CAWI	1.38	.86	.85	10.0
France[f]	176.1, .00**	CAWI	1.32	.89	.88	6.5
Germany	76.4, .71	PAPI	.65	.80	.81	8.7
Hungary[f]	137.0, .00**	CATI	1.21	.84	.83	9.3
Ireland	113.5, .02*	CATI	1.22	.82	.79	5.9
Israel[c]	111.2, .03*	CATI	1.42[h]		.85	
Israel	98.5, .13	CAWI	.95[h]	.87	.87	8.1

Country	χ², *p*	Mode	Mean[g]	Reliability		Dim (%)
				α	*PSI*	
Italy	159.7, .00**	CATI	.71	.84	.81	9.1
Italy	66.2, .92	CAWI	.81	.90	.88	8.0
Norway	91.5, .27	CATI	1.29	.84	.83	5.5
Portugal[f]	225.8, .00**	CATI	1.26	.90	.82	5.8
Russia[f]	135.3, .00**	PAPI	1.11	.90	.87	7.0
Slovakia	81.2, .56	CAPI	.88	.88	.88	9.1
Slovenia[f]	145.2, .00**	CAPI	1.67	.91	.88	7.3
Slovenia[f]	201.6, .00**	CAWI	1.85	.86	.84	6.9
Slovenia[d]	–	PAPI	–	–	–	
Switzerland[e1]	–	CATI	–	–	–	
Switzerland	84.4, .47	CAWI	1.18	.84	.84	8.7

Note. PCM=Rasch Partial Credit Model, α=Cronbach's alpha, PSI=Person Separation Index, $^*p < .05$, $^{**}p < .01$. The chi-square test for overall data-model fit using the PCM was based on G=8 groups of respondents (df=7 for a single item and df=84 for 12 items) and a reduced sample size with 20 persons for each of 36 thresholds n=720: $\chi^2(df=84, n=720)$, where the number of thresholds is 12 x (4-1) = 36.
[a]Austria applied CAPI and used CAWI in an additional comparable study.
[e2]Bulgaria applied CAPI (n=402) and CAWI (n=463) in small samples.
[b]The Czech Republic applied CATI in a medium sample (n=532) with 8 extreme scorers.
[c]Israel applied CATI in a small sample (n=311) with 25 extreme scorers.
[d]Slovenia applied PAPI in a minor sample (n=12) with no analysis reported.
[e1]Switzerland applied CATI in a minor sample (n=192) with no analysis reported.
[f]France, Hungary, Portugal, Russia, and Slovenia (CAWI and CAPI) have acceptable overall fit to the PCM when the sample size is reduced to 10 persons per threshold (n=360) for the chi-square test. The generalized partial credit model [GPCM] was estimated for each of these five countries.
[g]Mean Rasch-based health literacy proficiency (using the PCM with a 4-point raw score).
[h]Mean Rasch-based score when data for the two modes are merged to form a common point of zero. When analyzed separately, the mean is 1.06 and 1.57 (Austria), .80 and 1.23 (Czech Republic), and .87 and 1.81 (Israel) for CAWI and CATI, respectively. Only the two Austrian samples are comparable.

Source: HLS_{19} Consortium

5.6 How well the short forms HLS_{19}-Q12 and HLS_{19}-Q16 represent each other and the long form HLS_{19}-Q47 statistically

In the HLS-EU study, a predecessor of the current HLS_{19}-Q47 was used. Based on the need for a shorter, unidimensional scale with better psychometric properties, first the HLS-EU-Q16 and later the HLS-EU-Q12 measure were developed as short forms of the HLS-EU-Q47. For the HLS_{19} the three versions were revised slightly.

Six countries (BG, DE, IE, IT, NO, and SI) participating in the HLS_{19} used the HLS_{19}-Q47. The HLS_{19}-Q12 and the HLS_{19}-Q16 short forms can also be compared for the eight countries that used the 22 items set (BE, CZ, DK, HU, FR, IL, RU, and SK).

For the GEN-HL score, the Pearson correlation of the HLS_{19}-Q12 short form and the HLS_{19}-Q47 long form ranges between 0.898 (NO) and 0.949 (IT) (Table 5.6). The correlations of the HLS_{19}-Q16 scores with the HLS_{19}-Q47 scores (Table 5.7) and between the HLS_{19}-Q12 and HLS_{19}-Q16 scores (Table 5.8) are in a similar range. Consequently, the HLS_{19}-Q12 behaves in a sufficiently equivalent manner to the HLS_{19}-Q47 or the HLS_{19}-Q16 so that it can be used as a short form substitute, and the results of publications using the different measures can be compared to a certain degree. In addition, the HLS_{19}-Q12 has better psychometrical properties, since the HLS_{19}-Q47 was not proven to be a unidimensional scale by means of Rasch analyses. It should be noted though that, because the HLS_{19}-Q47 is not proven to be a unidimensional scale, it is not guaranteed that the HLS_{19}-Q47 and the HLS_{19}-Q12 strictly measure the same latent construct.

Table 5.6:
Pearson correlation of the HLS_{19}-Q12 and HLS_{19}-Q16 scores with the HLS_{19}-Q47 scores for BG, DE, IE, IT, NO, and SI and the mean for these countries

	BG	DE	IE	IT	NO	SI	Mean
Q47 x Q12 GEN-HL	.917	.919	.901	.949	.898	.927	.929
Q47 x Q16 GEN-HL	.922	.926	.916	.956	.909	.940	.936

Source: HLS_{19} Consortium

Table 5.7:
Pearson correlation of the HLS_{19}-Q16 scores with the HLS_{19}-Q12 scores for BE, BG, CZ, DE, DK, FR, HU, IE, IL, IT, NO, RU, SI, and SK, and the mean correlation across these countries

	BE	BG	CZ	DE	DK	FR	HU	IE	IL	IT	NO	RU	SI	SK	Mean
Q16 x Q12 GEN-HL	.924	.906	.899	.889	.901	.930	.891	.879	.921	.934	.871	.938	.916	.929	.917

Source: HLS_{19} Consortium

5.7 Distributions of the HLS19-Q12 scores

The standardized score ranges from 0 to 100, with higher values referring to a higher level of General HL (cf. Section 4.2). The distribution of the scores is negatively (left) skewed for all countries, with a considerable ceiling effect (Figure 5.3), which again indicates that the items asked about tasks that many respondents found manageable. In most countries, the 75% quantile is close or equal to the maximum value of 100, which indicates a ceiling effect (Table 5.8). This ceiling effect does not affect the identification of respondents with low levels of health literacy, however. Thus, the instrument is still sensitive for respondents with lower HL. This skewness does pose problems for some statistical analyses. The distribution is approximately symmetric only for the German data.

Figure 5.3:
Histograms of the HLS19-Q12 scores, for all countries

Source: HLS19 Consortium

Table 5.8:
Means, standard deviations, and percentiles for the HLS_{19}-Q12 score, by country

	Mean	SD	25th percentile	Median	75th percentile
AT	84.8	16.1	75.0	90.9	100.0
BE	65.7	26.7	50.0	66.7	91.7
BG	68.5	23.1	54.5	66.7	90.0
CH	77.3	19.6	66.7	83.3	91.7
CZ	76.3	22.3	63.6	83.3	91.7
DE	64.9	21.9	50.0	66.7	83.3
DK	77.4	20.5	66.7	83.3	91.7
FR	77.5	22.9	58.3	83.3	100.0
HU	79.8	19.8	66.7	83.3	91.7
IE	78.8	19.5	66.7	83.3	91.7
IL	73.0	23.9	58.3	75.0	91.7
IT	69.1	27.4	50.0	75.0	91.7
NO	78.8	19.2	66.7	83.3	91.7
PT	84.8	20.5	80.0	91.7	100.0
RU	80.3	23.3	66.7	90.9	100.0
SI	86.0	19.1	83.3	91.7	100.0
SK	69.7	25.1	50.0	75.0	91.7
All	76.0	22.9	58.3	83.3	91.7

Source: HLS_{19} Consortium

5.8 Differences in mean HLS_{19}-Q12 scores between the country sample and selected vulnerable subpopulations

In the context of policy making, it is important to know for which vulnerable or disadvantaged subpopulation the average level of HL is particularly low. Based on experiences with the HLS-EU study, the following four socio-demographic or socio-economic indicators and three health or sickness behavior-related indicators were selected (cf. Subsection 4.5.1):

» advanced age (>76 years old)
» low education (ISCED code ≤ 1 on a scale from 0 to 8)
» low level in society/low social status (≤ 4 on a scale from 1 to 10)
» financial deprivation (≥ 50%, i.e., considerable, or severe financial deprivation)
» “very bad” or “bad” self-perceived health
» one or more long-term illnesses or health problems
» a high number of contacts with a GP/family doctor (≥ 6) within the last 12 months.

On average, the differences between the GEN-HL score for the various vulnerable subpopulations and the overall country mean vary between -2.6 and -13.8 score points. There is considerable variation by country (Table 5.10).

The highest average difference between the "subpopulation means" and the country's GEN-HL mean score is found for the subpopulation with "poor self-perceived health", which is -13.8 below the total mean (62.2 vs. 76.0). The difference varies by country, from -5.2 (CZ) to -27.4 (PT). The "financially deprived" subpopulation shows a difference of -8.2 points (ranging from +0.7 (BE) to -14.4 (BG)). The third largest difference is found for the respondents reporting "low level in society/low social status" (-7.9), with a variation across countries ranging from -2.0 (AT) to -17.9 (BG). The lowest average difference was found for respondents with one or more reported "long-term illnesses or health problems" at -2.6 (varying from -0.3 (CZ) to -7.2 (PT)). Average differences for the other defined subgroups are -6.3 for "low education" (ranging from +0.6 (CZ) to -21.7 (RU)), -4.5 for "six or more contacts with a GP/family doctor" within one year (ranging from -06 (CZ) to -11.5 (BG, SK)), and -4.9 for respondents "aged 76 or older" (ranging from +6.6 (CZ) to -24.4 (PT). Three of these vulnerable subpopulations had unexpected, positive differences from the national country mean (i.e., better HL than the average population) in one to three countries.

Table 5.9:
Differences in mean HLS_{19}-Q12 scores between the country sample and selected vulnerable subpopulations, for each country and the mean for all countries (equally weighted)

	AT	BE	BG	CH	CZ	DE	DK	FR	HU	IE	IL	IT	NO	PT	RU	SI	SK	All
GEN-HL country mean	84.8	65.7	68.5	77.3	76.3	64.9	77.4	77.5	79.8	78.8	73.0	69.1	78.8	84.8	80.3	86.0	69.7	76.0
Aged 76 or older	3.4	3.3	−23.4	2.1	6.6	−6.1	3.6	–	0.0	−0.1	–	−1.5	−0.6	−24.4	−19.2	−14.1	−22.4	−4.9
Education at ISCED levels 0 or 1	–	–	−20.7	−8.2	0.6	–	−2.6	–	−3.0	−4.7	−3.4	−1.9	−3.2	−10.5	−21.7	−9.6	−20.4	−6.3
Level in society less than or equal to 4	−2.0	−5.8	−17.9	−4.1	−5.6	−7.4	−7.9	−5.5	−3.7	−7.4	−9.1	−7.4	−4.6	−9.3	−13.2	−6.5	−16.7	−7.9
Considerable or severe financial deprivation	−7.5	0.7	−14.3	−4.8	−7.3	−7.7	−10.7	−8.3	−7.0	−9.0	−7.1	−8.3	−12.9	−9.5	−9.5	−5.8	−10.6	−8.2
Bad or very bad self-perceived health	−9.1	−8.7	−34.3	−11.3	−5.2	−12.9	−12.1	−9.5	−10.7	−13.1	−5.4	−9.3	−7.9	−27.4	−22.0	−16.1	−19.6	−13.8
One or more long-term illnesses or health problems	−2.2	−0.4	−4.1	−2.0	−0.3	−1.6	−1.9	−1.7	−2.1	−1.4	−1.9	−2.7	−1.6	−7.2	−6.3	−3.7	−2.9	−2.6
Limited by health problems	−4.6	−1.8	−8.2	−3.6	−1.5	−2.5	−3.4	−3.1	−5.1	−4.1	−2.7	−5.8	−2.3	−12.4	−6.7	−5.6	−5.6	−4.6
6 or more contacts with a GP/family doctor	−2.4	−2.7	−11.5	−4.6	−0.6	−4.3	−5.6	−3.2	−2.1	−4.7	−0.2	−2.8	−1.9	–	−10.6	−3.6	−11.5	−4.5

– Cells with less than 30 respondents were not reported.

Source: HLS_{19} Consortium

5.9 Categorical levels for the HLS_{19}-Q12

When reporting health literacy within certain subpopulations, it is sometimes advantageous to assign respondents to categorical health literacy levels, as was done in the HLS-EU and other studies. Since the calculation of the health literacy scores for the HLS_{19} deviates from the HLS-EU methodology and because the score was computed differently and thus has a different meaning, the calculation of such levels had to be adapted. To approximate the categorical levels based on the HLS-EU methodology, the HLS_{19} enriched the information from the score value with information about how often the extreme categories were selected. The terms used for the categorical levels are identical to the HLS-EU study. For details of definitions of the cutting points, the categorical levels for the HLS_{19}-Q12, and one possibly unexpected consequence, see Section 4.1.

Across all participating countries, about 40% of the respondents have a "sufficient" level of health literacy and about 15% an "excellent" level. On the other hand, about 33% have a "problematic" level of health literacy and 13% an "inadequate" level. The levels varied by country:

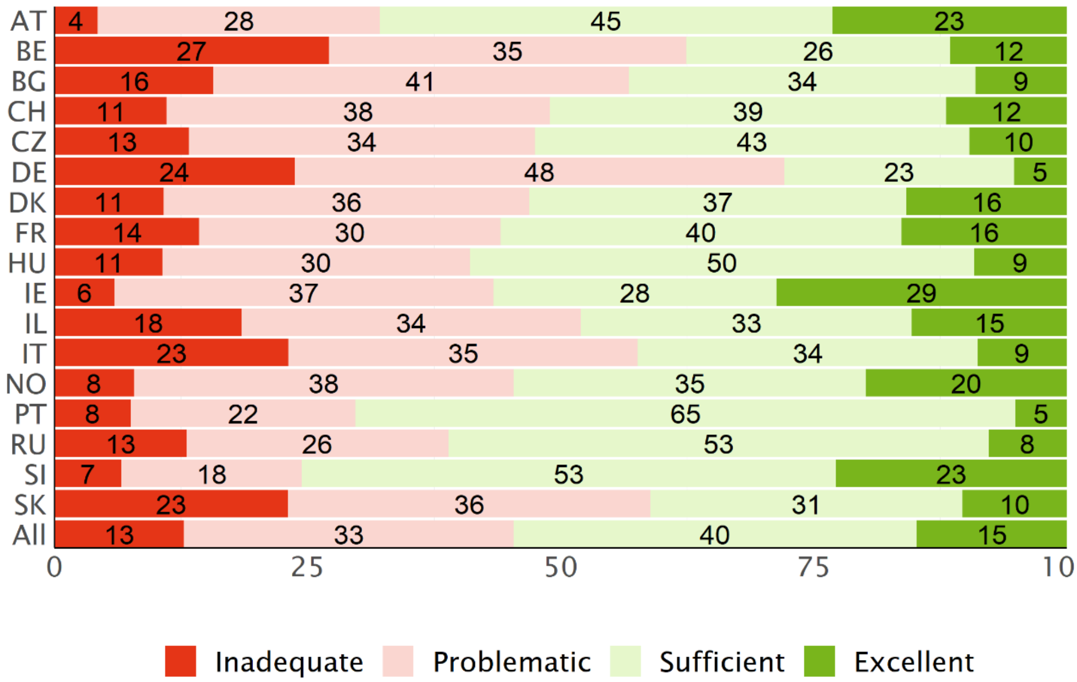
» "inadequate" General HL between 4% (AT) and 27% (BE),
» "problematic" General HL between 18% (SI) and 48% (DE),
» "sufficient" General HL between 23% (DE) and 65% (PT),
» "excellent" General HL between 5% (DE and PT) and 29% (IE).

For respondents at an "inadequate" level of HL, especially items 1, 2, 6, 7, 9, 11, and 12 were "difficult" or "very difficult" more often than for respondents with better health literacy (Table 5.10). For respondents at a "problematic" level of HL, specifically items 3, 5, and 8 were "difficult" or "very difficult" more often than for respondents with "sufficient" or "excellent" HL. These items were also "difficult" or "very difficult" more often for respondents with "sufficient" HL than for respondents with "excellent" HL (Table 5.10).

Respondents with an "inadequate" level of health literacy tend to say their health is worse than other respondents (Figure 5.5), with the relationship between self-reported health and level of health literacy being almost linear for most countries.

In line with the HLS-EU study, when the HL categorical levels "inadequate" and "problematic" are combined as "limited health literacy", the resulting variation ranges from 25% (SI) to 72% (DE), i.e., between one out of four (in SI) and three out of four (in DE) residents in participating countries have limited General HL. Compared to the HLS-EU, with one out of three up to two out of three, the variation between countries is even more pronounced, which could be the result of different methodology and different countries being included in the two studies.

Figure 5.4:
Percentage of respondents by categorical level of General HL as measured by the HLS19-Q12, for each country and the mean for all countries



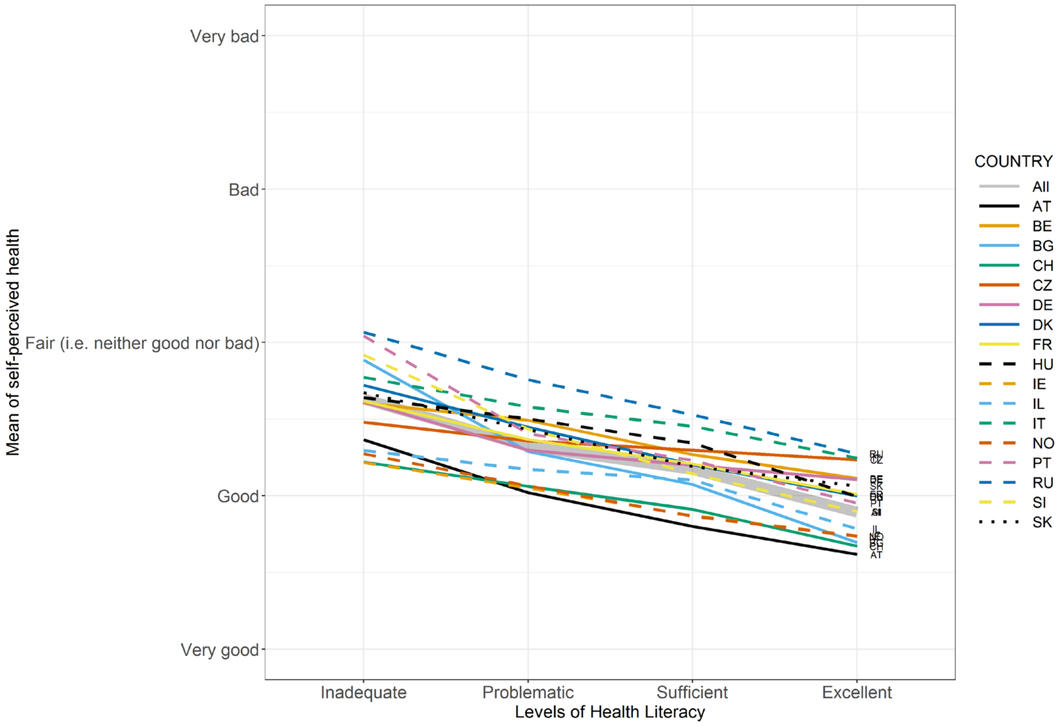
Source: HLS19 Consortium

Table 5.10:
Percentage of difficulty of each item for each level of General HL, for all countries (equally weighted)

	Inade-quate	Problem-atic	Sufficient	Excellent	Total
3 … to judge the advantages and disadvantages of different treatment options?	88.42	68.42	19.90	5.67	42.44
8 … to decide how you can protect yourself from illness using information from the mass media?	84.84	60.50	18.44	8.79	39.24
5 … to find information on how to handle mental health problems?	85.47	58.71	14.01	4.13	36.35
12 … to make decisions to improve your health and well-being?	73.53	38.11	8.62	2.56	25.67
2 … to understand information about what to do in a medical emergency?	70.47	33.59	5.77	1.90	22.57
11 … to judge how your housing conditions may affect your health and well-being?	70.03	32.63	5.44	1.37	21.97
6 … to understand information about recom-mended health screenings or examinations?	62.04	24.91	3.85	0.93	17.76
7 … to judge if information on unhealthy habits, such as smoking, low physical activity, or drinking too much alcohol, is reliable?	64.60	24.63	3.34	0.59	17.73
10 … to understand advice concerning your health from family or friends?	50.99	23.46	5.15	1.57	16.47
1 … to find out where to get professional help when you are ill?	54.94	22.83	4.02	1.01	16.26
9 … to find information on healthy lifestyles such as physical exercise, healthy food, or nutrition?	44.24	11.51	1.53	0.31	10.08
4 … to act on advice from your doctor or pharma-cist?	32.94	9.64	1.54	0.46	8.06
Mean	65.21	34.08	7.63	2.44	22.88

Source: HLS_{19} Consortium

Figure 5.5:
Average self-perceived health by level of General HL, for each country and the mean for all countries



Source: HLS19 Consortium

5.10 Discussion and conclusions

The score for the HLS19-Q12 measure was calculated for dichotomized item categories ("very easy" or "easy") to avoid assigning numbers to the ordinal response categories of the items constituting the measure and was standardized from 0 to 100% for better comparability and interpretation of the measure. The distribution of the score values is negatively skewed in all countries. In most countries, this resulted in a ceiling effect. Future research should clarify the extent to which this is due to the scale items being too easy, or to different survey modalities, or both. The ordering of the items in relation to the percentage of respondents finding the task "difficult" or "very difficult" across the participating countries suggests that the scale is working adequately.

The Cronbach alpha coefficients demonstrate sufficient internal consistency. The confirmative factor analyses demonstrate a good model fit for a single latent variable model. The Rasch analyses support the use of the HLS19-Q12 as a unidimensional measure for health literacy. However, the Rasch analyses also suggest opportunities for improvement by modifying items in a future development of the HLS19 questionnaire. Some items display DIF for different person factors, such as age and gender, and for the variable "country". The correlation of the HLS19-Q12 and HLS19-Q47

GEN-HL scores is sufficiently high to accept that the HLS_{19}-Q12 short form can be used as an equivalent for the HL-Q47 long form and that studies using the different forms can be compared.

However, due to the considerable methodological differences between the HLS_{19} and the HLS-EU, the results of the two studies can only be compared to a certain degree.

In conclusion, the HLS_{19}-Q12 is a psychometrically rather sound instrument for measuring comprehensive General HL in adult populations as intended in the HLS_{19}.

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6 Determinants and a social gradient of General Health Literacy measured by the HLS_{19}-Q12

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6.1 Background

To select determinants of HL in the HLS_{19}, the HLS-EU conceptual model of HL (Sørensen et al. 2012) was used in its refined, more detailed, explicit causal version of the Vienna Model of Health Literacy (see Figure 1.2, Chapter 1) (Pelikan/Ganahl 2017).

According to the Vienna Model, the personal HL of an individual is influenced by *personal* determinants, like socio-demographic and socio-economic variables, such as gender, age, educational level, self-assessed level in society, and financial deprivation (as used in HLS-EU publications) as well as by *situational* determinants, such as characteristics of health (care) systems and regional characteristics (e.g., rural/urban). In this chapter we focus on selected personal socio-demographic and socio-economic variables that were used in the HLS-EU study.

In the HLS-EU study it was demonstrated that there is a *social gradient* for health literacy by using indicators for gender, age, educational level, self-assessed level in society, and financial deprivation in the regression model (HLS-EU Consortium 2012; Sørensen et al. 2015), which was also confirmed by further studies, e.g., by Duong et al. (2017); Schaeffer et al. (2017); Stormacq et al. (2019). For all eight countries in the HLS-EU, the significant predictors for HL, ordered by the strength of β coefficients in a linear regression model, which explained on average 17% of the variance (varying across countries from 8% to 25%), were, from highest to lowest, financial deprivation (on average $\beta=-.24$), followed by self-assessed level in society (on average $\beta=.14$), education ($\beta=.13$), age ($\beta=-.09$), and gender ($\beta=.06$) (HLS-EU Consortium 2012; Sørensen et al. 2015).

For this chapter, following the underlying generic causal model and the results of existing research, the main research questions were:

» How strongly is General HL associated with socio-demographic, socio-economic and additional selected determinants?
» Is there a social gradient for HL?

Of course, with cross-sectional data, these questions can only be answered in a limited, explorative way, but the underlying causal assumptions are very plausible for the independent variables used in the specified regression model.

To answer the research questions, five core socio-demographic and socio-economic determinants were used: gender and age for the former and education, level in society, and financial deprivation for the latter. The following determinants, which were partly used in the HLS-EU and other studies, were also investigated: migration background, long-term illness, being trained in a healthcare profession, and partly status of employment (for status of employment, a figure with the distributions and a table with the means of General HL are only provided in Annex 6). For all selected determinants, a detailed overview of the measured indicators is provided in Annex 6, Table A 6.1, including the wording of the items and their response categories used in the HLS_{19}, the source of the original item, and an indication of changes made compared to the item used in the predecessor study, the HLS-EU.

In connection with results relating to each of the five, core socio-demographic and socio-economic, determinants mentioned in the published literature, the following points can be highlighted:

Gender: published results are inconsistent. The HLS-EU study found on average a weak significant β coefficient showing females to have higher health literacy scores than males, but this was not significant in a few countries in the HLS-EU. In a systematic review of HL studies in Iran, six were identified which showed that being a woman was associated with lower HL, and two studies found that men had lower HL (Kamal et al. (2018). Men having lower HL was also demonstrated by Almaleh et al. (2017), while Matsumoto/Nakayama (2017) found higher HL in women. However, many studies did not find differences between women and men in HL (Garcia-Codina et al. 2019; Jordan/Hoebel 2015; Tiller et al. 2015).

Age: published results are inconsistent. In two reviews, older age was associated with lower HL (Berkman et al. 2011; Kamal et al. 2018). In the HLS-EU for age, β=-.09 was found for all countries together, but the values were statistically significant for only five out of the eight countries (from β=-.14 to β=-.16) (HLS-EU Consortium 2012). An increase in HL with age was shown by Tiller et al. (2015), and higher HL in older populations was also found by Matsumoto/Nakayama (2017).

Education: a positive, significant association of HL with education was shown in the HLS-EU study (β=.13 for all countries together), but it was only statistically significant for six out of the eight countries (from β=.08 to β=.22) (HLS-EU Consortium 2012). A low educational level was found to be a risk factor for low HL by van der Heide et al. (2013), Friis et al. (2016), Kamal et al. (2018), Fleary/Ettienne (2019), and Svendsen et al. (2020).

Level in society (social status): a significant, positive association was shown with HL in the HLS-EU study (β=.14 for all countries together), but it was only statistically significant for six out of the eight countries (from β=.07 to β=.23) (HLS-EU Consortium 2012). A higher risk of limited HL was found for persons with lower social status in van der Heide et al. (2013a), Berens et al. (2016), Rikard et al. (2016), and Duong et al. (2017).

Financial deprivation: a significant, negative association with HL was demonstrated in the HLS-EU study (β=-.24 for all countries together, ranging from -.07 to β=-.35) (HLS-EU Consortium 2012). Financial deprivation was also associated with lower HL in studies by Levin-Zamir et al. (2016), Palumbo et al. (2016), and Vogt et al. (2017). Furthermore, low economic status including low income was found to be a risk factor for lower HL by Kamal et al. (2018).

In addition to these five socio-demographic and socio-economic indicators, the effects of three further indicators were investigated, namely migrant status, long-term illness, and training in a health profession.

6.2 Distribution of selected determinants, their associations, and correlations with HL

Overview of the presentations of results

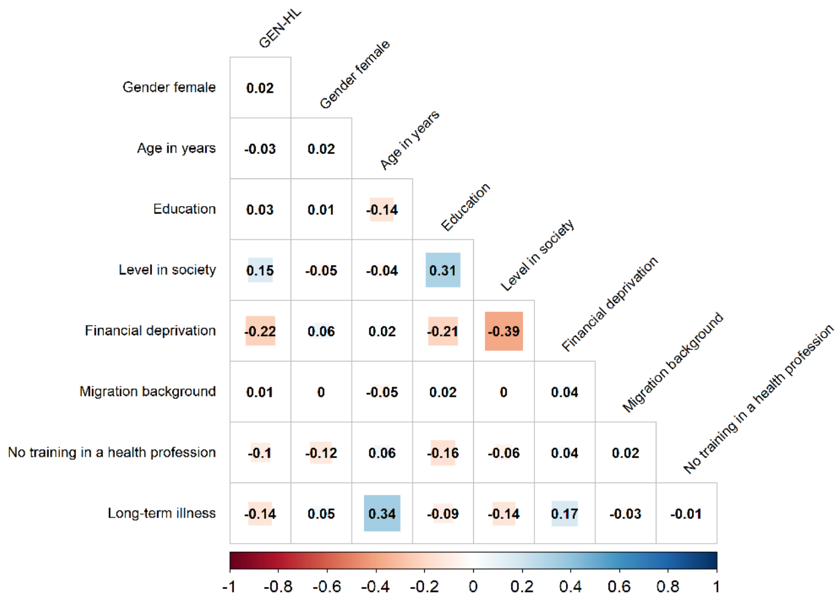
First, correlations between the five socio-demographic and socio-economic determinants plus three further ones, and with General HL are presented for all countries together (with each country weighted by 1,000) (Figure 6.1). Then distributions are presented for the selected determinants. For the distributions of some of the determinants, it must be kept in mind that the data were weighted for most countries by gender, age group, population density, regional administrative units, and partly for education (for details of data weighting by country, see Section 2.4). The distributions are followed by the associations of each determinant with General HL, with line charts showing the relation of the mean HL values with selected determinants. Correlations of General HL with selected determinants for each country are presented in Table 6.1 and are described in the relevant sections for the single determinants.

Correlations between the five socio-demographic and socio-economic plus three further determinants, and with General HL

As can be expected, the five socio-demographic and socio-economic determinants treated as core determinants correlate with each other, the highest for *level in society* with financial deprivation ($\rho=-0.39$) and with education ($\rho=0.31$), followed by *education* with financial deprivation ($\rho=-0.21$) and with age ($\rho=-0.14$). Of these, only financial deprivation ($\rho=-0.22$) and level in society ($\rho=0.15$) correlate to a considerable degree with General HL.

For the three additional determinants, migration background, trained in a healthcare profession, health status, and long-term illness, included in the International Report, the highest correlations are between long-term illness and age ($\rho=0.34$), with financial deprivation ($\rho=0.17$), and with level in society ($\rho=-0.14$). Only long-term illness ($\rho=-0.14$) and training in a health profession ($\rho=-0.10$) are correlated to General HL (Figure 6.1).

Figure 6.1:
Spearman correlations (ρ) between GEN-HL and selected determinants, for all countries (equally weighted)*



* Values for the correlations with migration should be treated with caution as in five countries (BG, HU, IT, RU, and SK) the percentage of respondents with a migration background was below 10%, and the HLS_{19} survey as such was not adjusted to targeting migrants specifically (e.g., by offering translations of the instrument into migrant languages).

Source: HLS_{19} Consortium

Table 6.1:
Spearman correlations (ρ) between GEN-HL and selected determinants, for each country and for all countries (equally weighted)

	AT	BE	BG	CH	CZ	DE	DK	FR	HU	IE	IL	IT	NO	PT	RU	SI	SK	All
Gender female	0.04	0.02	0.01	0	0.04	0.04	0.04	0	−0.03	0.06	0.03	0.02	0.08	−0.05	−0.03	0.03	0.01	0.02
Age in years	−0.06	0.07	−0.21	0.04	0.14	−0.07	0.11	0.02	0.11	0.06	0.14	−0.06	0.01	−0.18	−0.23	−0.09	−0.19	−0.03
Education	−0.01	0	0.2	0.04	−0.13	0.22	0.1	0	0.07	0.09	−0.03	0.05	0.08	0.24	0.09	0.14	0.23	0.03
Level in society	−0.01	0.22	0.4	0.14	0.15	0.22	0.18	0.16	0.11	0.17	0.2	0.15	0.13	0.27	0.35	0.18	0.29	0.15
Financial deprivation	−0.19	0	−0.33	−0.16	−0.23	−0.21	−0.24	−0.19	−0.26	−0.28	−0.24	−0.26	−0.16	−0.33	−0.41	−0.25	−0.39	−0.22
Migration*	0.07	−0.04	0.04	0.05	−0.02	−0.03	−0.02	−0.02	−0.03	0.01	0	−0.01	0	−0.01	0.04	−0.02	−0.03	0.01
No training in a health profession	0.01	−0.05	−0.29	−0.09	−0.06	−0.18	−0.1	−0.08	−0.06	−0.04	−0.08	−0.09	−0.12	−0.12	−0.09	−0.09	−0.19	−0.10
Long-term illness	−0.11	−0.03	−0.24	−0.09	−0.03	−0.09	−0.09	−0.08	−0.08	−0.06	−0.04	−0.09	−0.09	−0.26	−0.28	−0.12	−0.17	−0.14

Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).

Level in society from 1=lowest level to 10=highest level in society.

Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

Long-term illness: 3 categories: (1) none, (2) one, (3) more than one, except for SI where 2 categories were used (1) none, (2) one or more.

Migration background: 0=none, 1=one parent born abroad, 2=both parents born abroad, 3=born abroad.

* Values for the correlations with migration should be treated with caution as in five countries (BG, HU, IT, RU, and SK) the percentage of respondents with migration background was below 10%, and the HLS_{19} survey as such was not adjusted to targeting migrants specifically (e.g., by offering translations of the instrument into migrant languages).

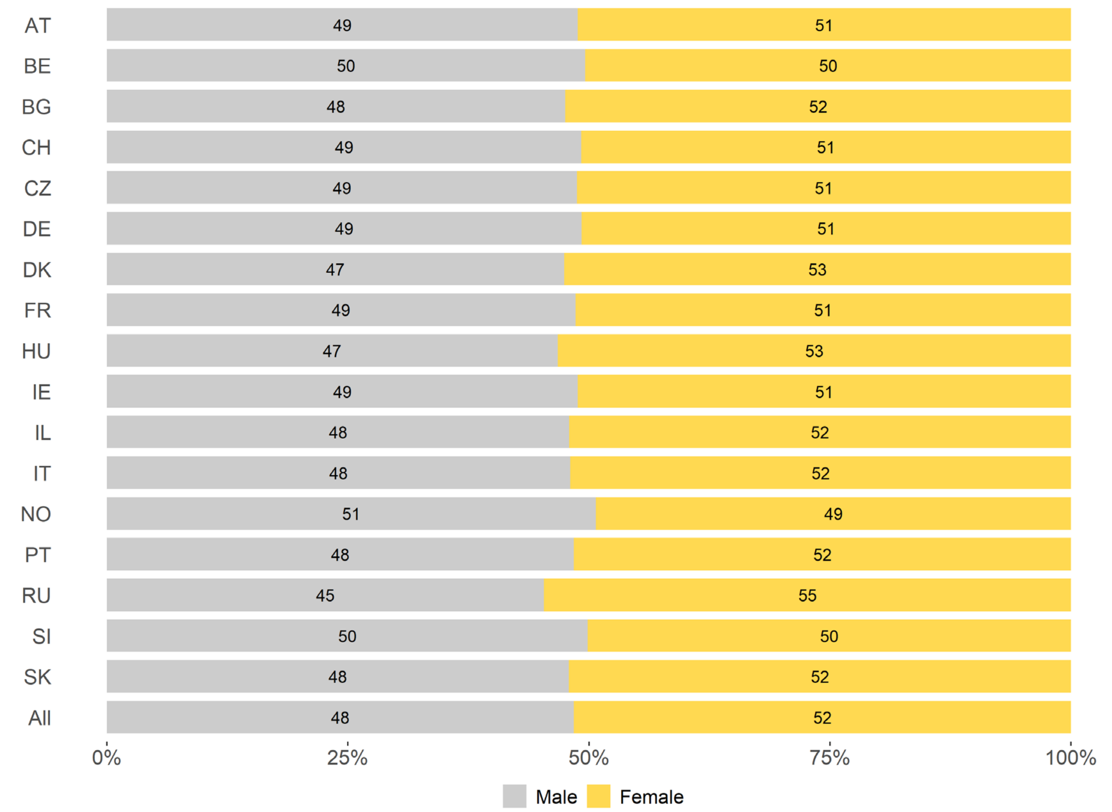
Source: HLS_{19} Consortium

6.2.1 Socio-demographic determinants: Gender and age

Gender

Gender is evenly distributed with an equal or somewhat lower percentage of men (on average 48%) for all participating countries (Figure 6.2). The lowest proportion of men is 45% (RU) and the highest 51% (NO).

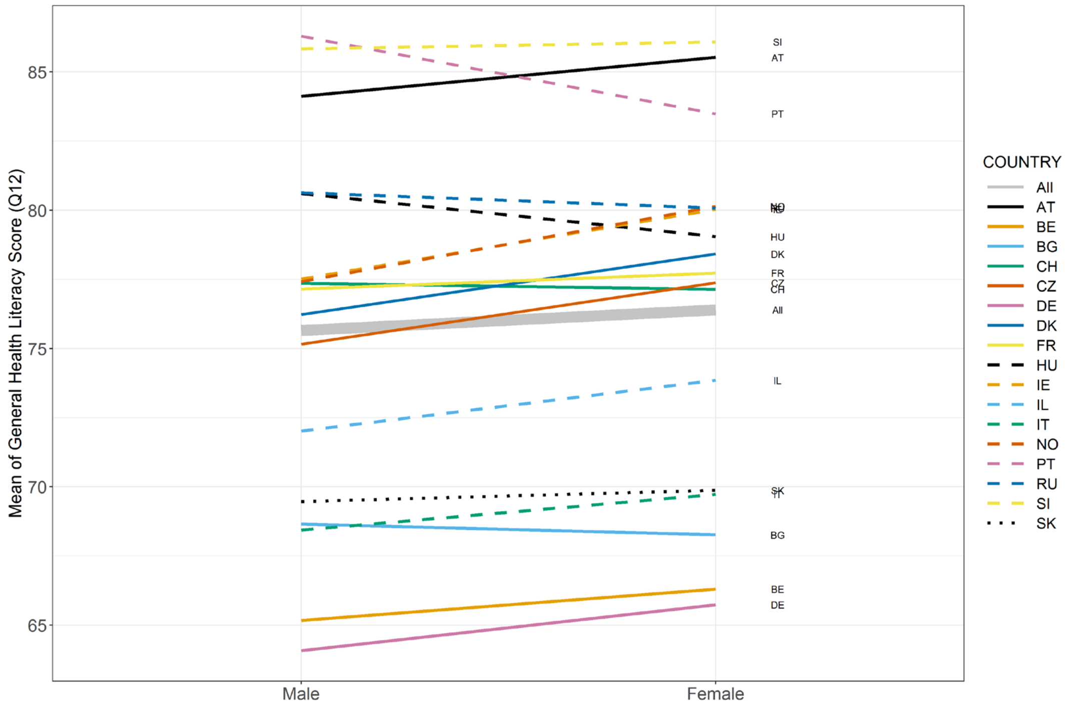
Figure 6.2:
Percentage distribution of gender, for each country and for all countries (equally weighted)



Source: HLS19 Consortium

With a mean correlation of ρ=0.02, gender is only very weakly associated with General HL. The values of the correlation coefficients are low for all countries. Women have slightly higher General HL in most countries, varying from ρ=0 (CH, FR) to 0.08 (NO), with the exception of HU, RU (ρ=-0.03), and PT (ρ=-0.05), where men have somewhat higher General HL (Table 6.1 and Figure 6.3).

Figure 6.3
Means of GEN-HL scores by gender, for each country and for all countries (equally weighted)



Source: HLS19 Consortium

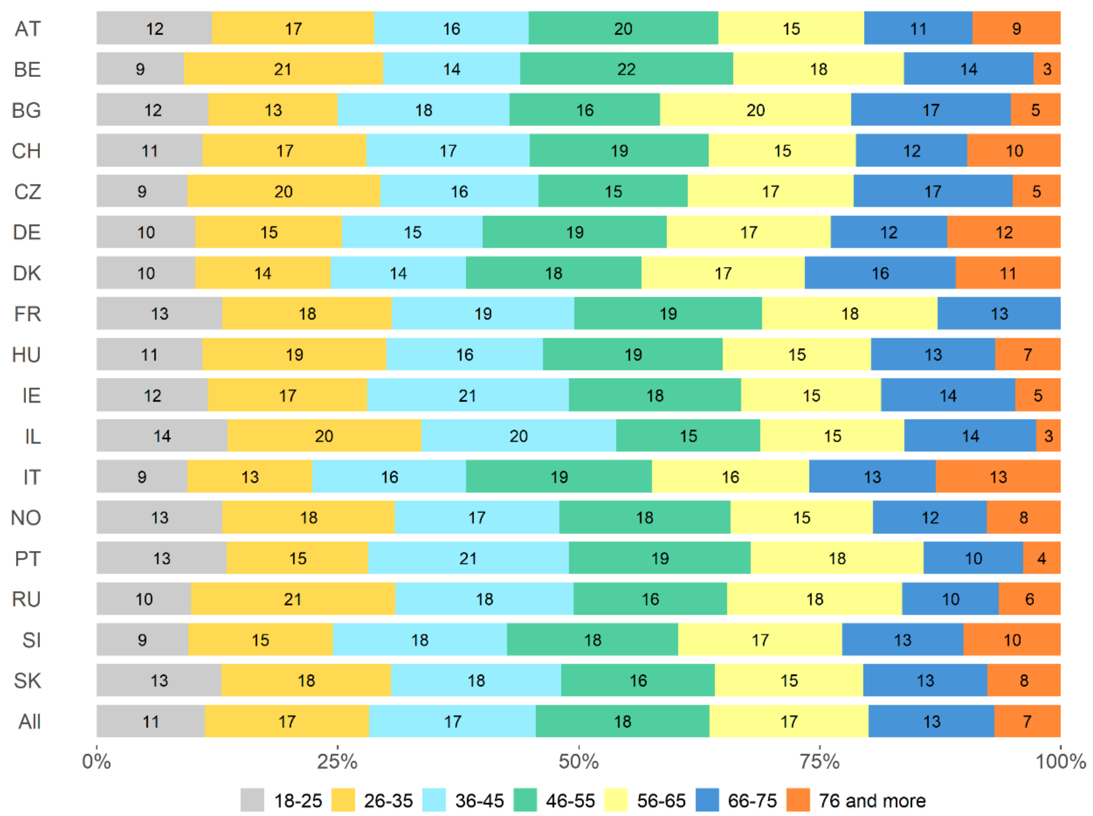
Age

Age was measured in years but is grouped into seven categories (Figure 6.4). The relative size of these categories (for overall countries 11% in 18–25 years, 17% in 26–35 years, 17% in 36–45 years, 18% in 46–55 years, 17% in 56–65 years, 13% in 66–75 years, 7% in 76 and more years) varies somewhat by country (Figure 6.4). This is also reflected in the means and standard deviations for age, with an overall mean of 48.1 years (varying from 45.6 (IL) to 51.6 (DK)) and an overall standard deviation of 17.4 (varying from 15.7 (FR) to 18.6 (IT)) (Table 6.2).

The median age for all countries is 48 years (varying from 44 years (IL) to 53 years (DK)). The overall value for all countries for the 25th percentile is 33 years (varying from 31 years (IL, NO) to 38 years (IT)) and the overall value for the 75th percentile is 62 years (varying from 59 years (FR, PT) to 67 years (DK)) (Table 6.2).

In most participating countries, the association of General HL with age is nonlinear in different ways (Figure 6.5). Therefore, the overall association of age with General HL for all countries is low with a Spearman coefficient of ρ=–0.03 (Table 6.1). There are countries with an expected negative correlation, ranging from ρ=–0.06 (AT) to ρ=–0.23 (RU) as well as countries with an unexpected somewhat lower positive correlation, ranging from ρ=0.01(NO) to ρ=0.11 (DK, HU) (Table 6.1).

Figure 6.4:
Percentage distribution of age groups in seven categories, for each country and for all countries (equally weighted)*



* FR did not include participants above 75 in the survey.

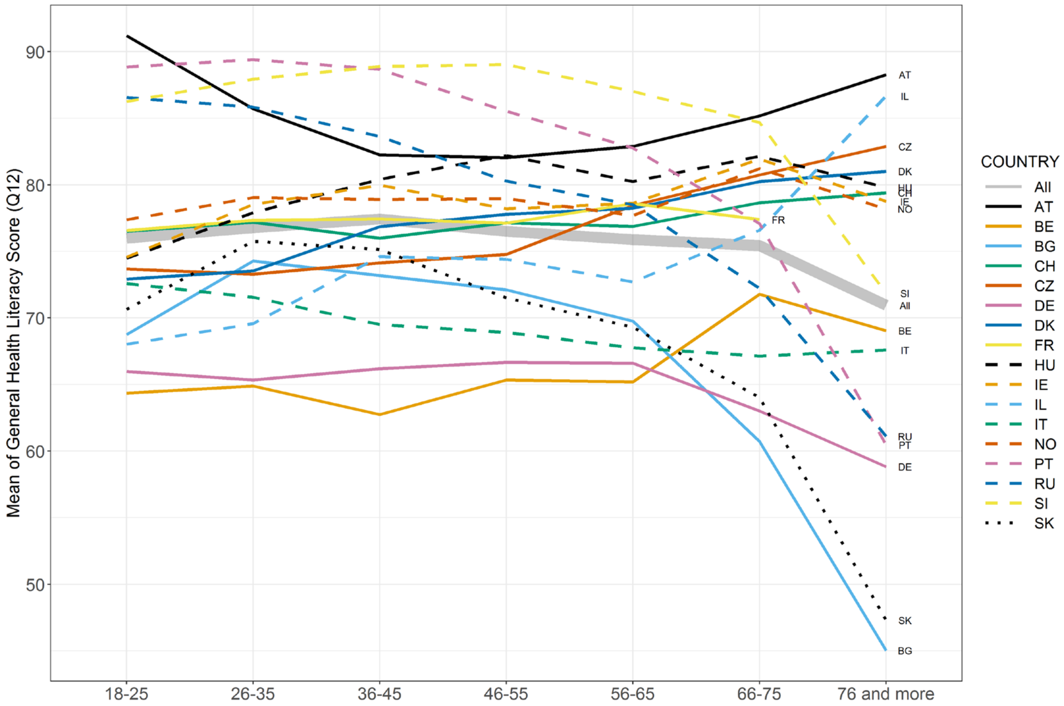
Source: HLS19 Consortium

Table 6.2:
Means, standard deviations, and percentiles of age distributions, for each country and for all countries (equally weighted)

	AT	BE	BG	CH	CZ	DE	DK	FR	HU	IE	IL	IT	NO	PT	RU	SI	SK	All
Mean	48.9	47.8	49.2	49	48.6	50.8	51.6	46.1	48.0	46.5	45.6	51.9	46.6	46.1	47.5	50.4	47.6	48.1
SD	17.8	16.1	17.6	18.3	17.1	18.5	18.2	15.7	17.5	17.0	16.7	18.6	18.5	16.7	17.3	18.2	18	17.4
25th percentile	34.0	33.0	35.0	34.0	33.0	35.0	36.0	34.0	33.0	32.0	31.0	38.0	31.0	33.0	33.0	36.0	32.0	33.0
50th percentile	49.0	49.0	50.0	48.0	48.0	50.0	53.0	46.0	48.0	47.0	44.0	51.0	46.0	46.0	46.0	50.0	46.0	48.0
75th percentile	63.0	61.0	63.0	62.0	63.0	65.0	67.0	59.0	62.0	62.0	60.0	66.0	62.0	59.0	61.0	64.0	62.0	62.0

Source: HLS_{19} Consortium

Figure 6.5
Means of GEN-HL scores by age in seven groups, for each country and for all countries (equally weighted)



Source: HLS19 Consortium

6.2.2 Socio-economic determinants: Level in society, education, and financial deprivation

Level in Society

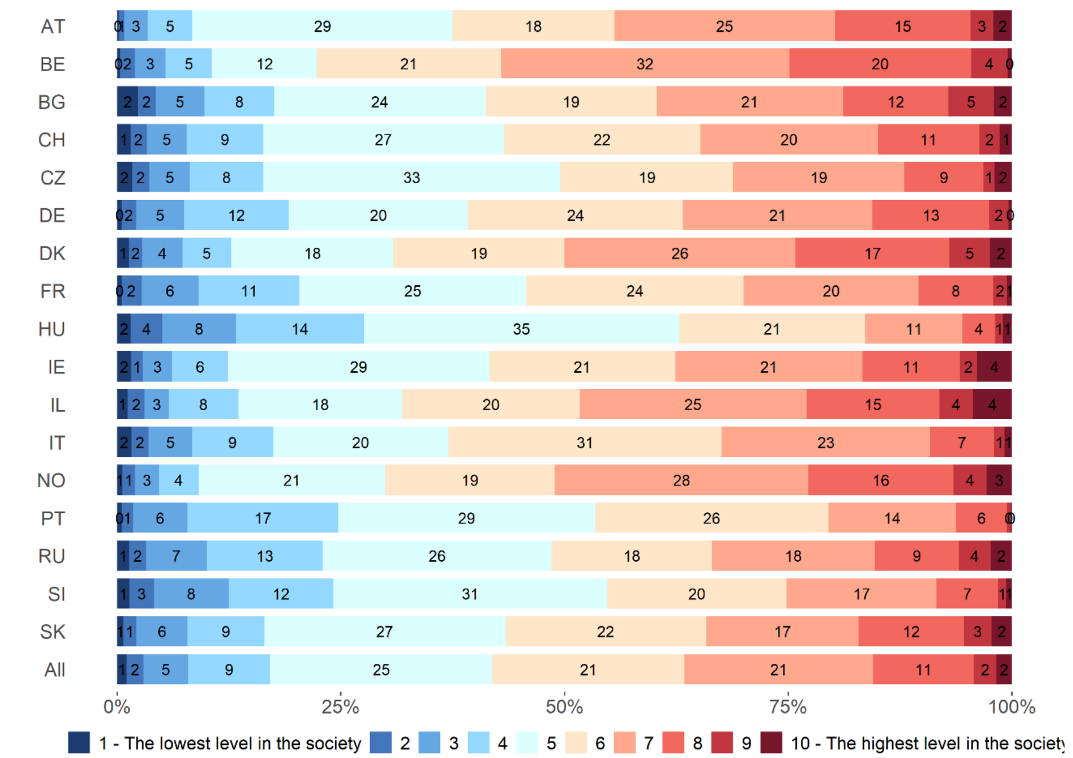
Level in society was measured by a measure taken from the Eurobarometer which was also used in the HLS-EU. This measure varies from 1 (=lowest self-assessed level in society) to 10 (=highest level in society). It is approximately normally distributed, but its variation across countries is considerable (Figure 6.6).

The mean self-assessed level in society for all countries together is 5.9 (varying from 5.1 (HU) to 6.5 (BE)) with a standard deviation of 1.6 (varying from 1.4 (PT) to 1.8 (BG, IL, RU)) (Table 6.3).

The correlation for General HL with level in society has a Spearman coefficient of ρ=0.15 on average (vaying from -0.01 (AT) to 0.4 (BG)) and is the second strongest of all included determinants (Table 6.1).

Due to a few cases in the extreme answer categories 1 and 2 plus 9 and 10 (Figure 6.6), the answer categories 1 and 2 (shown as 1–2), and the answer categories 9 and 10 (shown as 9–10) were collated for Figure 6.7 on associations. The association is more or less linear for all countries but on a somewhat different level of General HL. On average, respondents with a higher level in society have better HL, except for IT, where only a low number of cases for level 9 and 10 exist so that the mean value for this category may be not reliable (Figure 6.7).

Figure 6.6:
Percentage distribution of level in society, for each country and for all countries (equally weighted)



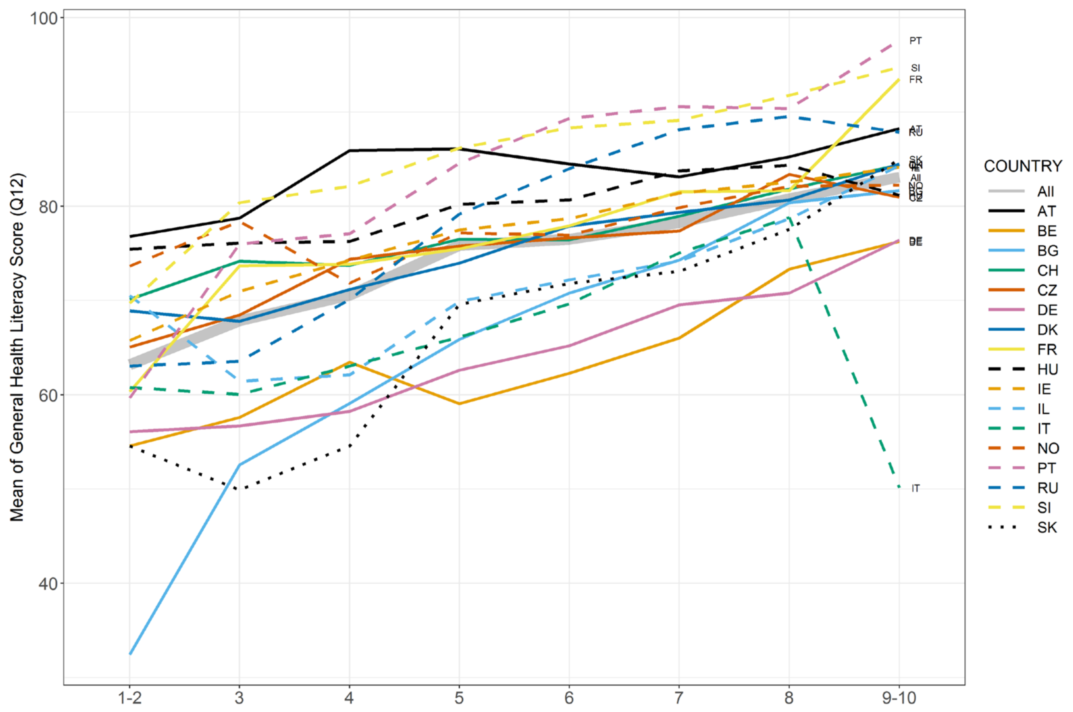
Source: HLS19 Consortium

Table 6.3:
Means, standard deviations, and percentiles of distribution of levels in society, for each country and for all countries (equally weighted)

	AT	BE	BG	CH	CZ	DE	DK	FR	HU	IE	IL	IT	NO	PT	RU	SI	SK	All
Mean	6.2	6.5	5.9	5.8	5.7	5.9	6.3	5.6	5.1	6.0	6.3	5.8	6.4	5.4	5.7	5.4	5.9	5.9
SD	1.5	1.5	1.8	1.7	1.6	1.6	1.7	1.5	1.5	1.7	1.8	1.5	1.6	1.4	1.8	1.6	1.7	1.6
25th percentile	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
50th percentile	6.0	7.0	6.0	6.0	6.0	6.0	7.0	6.0	5.0	6.0	6.0	6.0	7.0	5.0	6.0	5.0	6.0	6.0
75th percentile	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	6.0	7.0	7.0	7.0	7.0	6.0	7.0	7.0	7.0	7.0

Source: HLS19 Consortium

Figure 6.7:
Means of GEN-HL scores by level in society, for each country and for all countries (equally weighted)



Source: HLS19 Consortium

Education

Education was measured by ISCED, offering nine detailed categories (from 0 to 8), although some participating countries already merged some categories when collecting data to better reflect the educational system in their country.

To calculate correlations and regressions (see Sections 4.5 and 4.7 for details of the methods), the categories were interpreted as ordinal or interval scales respectively and used in that way.

To show the distributions of categories by countries (Figure 6.8), the nine categories were combined into four categories:

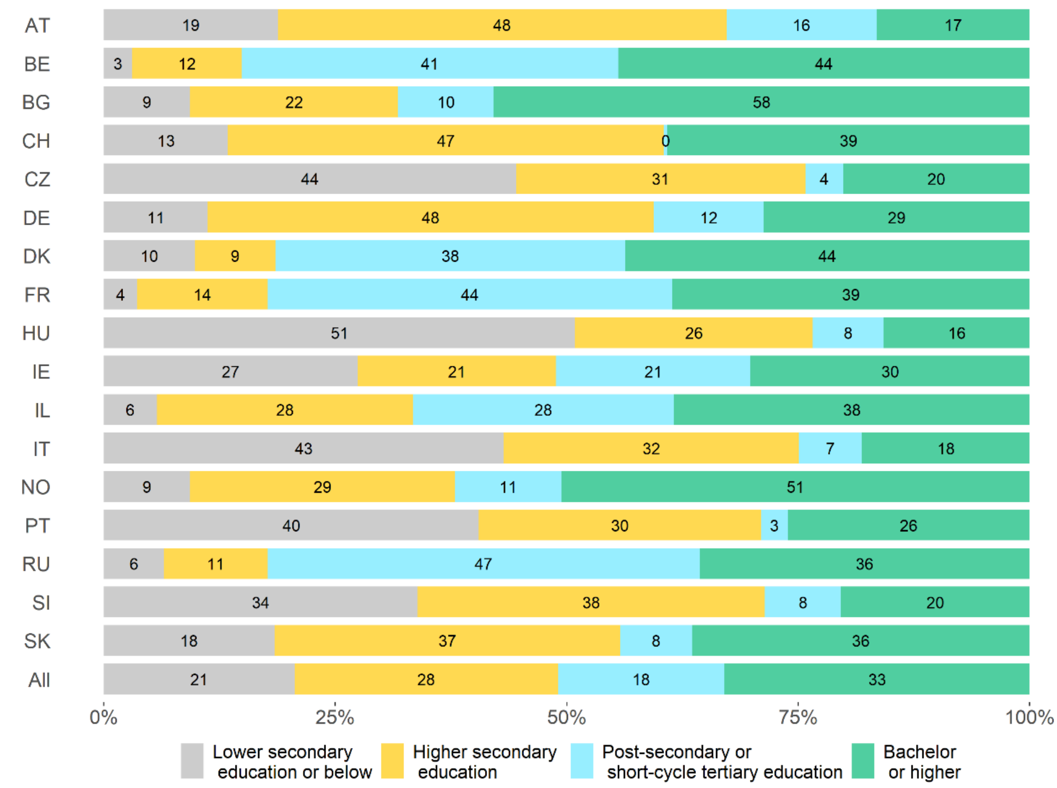
1. lower secondary education or below (up to ISCED-2)
2. higher secondary education (ISCED-3)
3. post-secondary or short-cycle tertiary education (ISCED-4 and 5)
4. bachelor or higher (ISCED-6 to 8)

The distribution of the four categories is 21% on average (varying from 3% (BE) to 51% (HU)) for lower secondary education and below, 28% (from 9% (DK) to 48% (AT, DE)) for higher secondary education, 18% (from 0% (CH) to 47% (RU)) for post-secondary or short cycle tertiary education, and 33% (from 16% (HU) to 58% (BG)) for bachelor or higher, and thus varies considerably by country (Figure 6.8).

The mean value with all countries weighted equally ("All"), calculated by using the nine categories, is 4.1 (varying from 3 (HU) to 5.3 (BG)), while for standard deviations it is 2.0 (varying from 1.3 (RU) to 2.1 (BG, PT, SK)) (Table 6.4). The median for all countries is 4.0 (from 2.0 (HU) to 6.0 (NO, BG)), the value of the 25th percentiles for all countries is 3.0 (from 2.0 (CZ, HU, IE, IT, PT, and SI) to 4.0 (BE, DK, FR, and RU)) and the value of the 75th percentiles for all countries is 6.0 (from 3.0 (CZ, HU, and IT) to 7.0 (BE, BG, and SK)) (Table 6.4).

Associations vary considerably by level and the format of the curves (Figure 6.9). The overall correlation of General HL with education is $\rho=0.03$. For most countries, it is positive (varying from $\rho=0.04$ (CH) to $\rho=0.24$ (PT)), while for three countries it is negative ($\rho=-0.01$ (AT), $\rho=-0.03$ (IL), $\rho=-0.13$ (CZ), $\rho=0$ for BE and FR (Table 6.1).

Figure 6.8:
Percentage distribution of educational levels (four grouped categories), for each country and for all countries (equally weighted)



Source: HLS19 Consortium

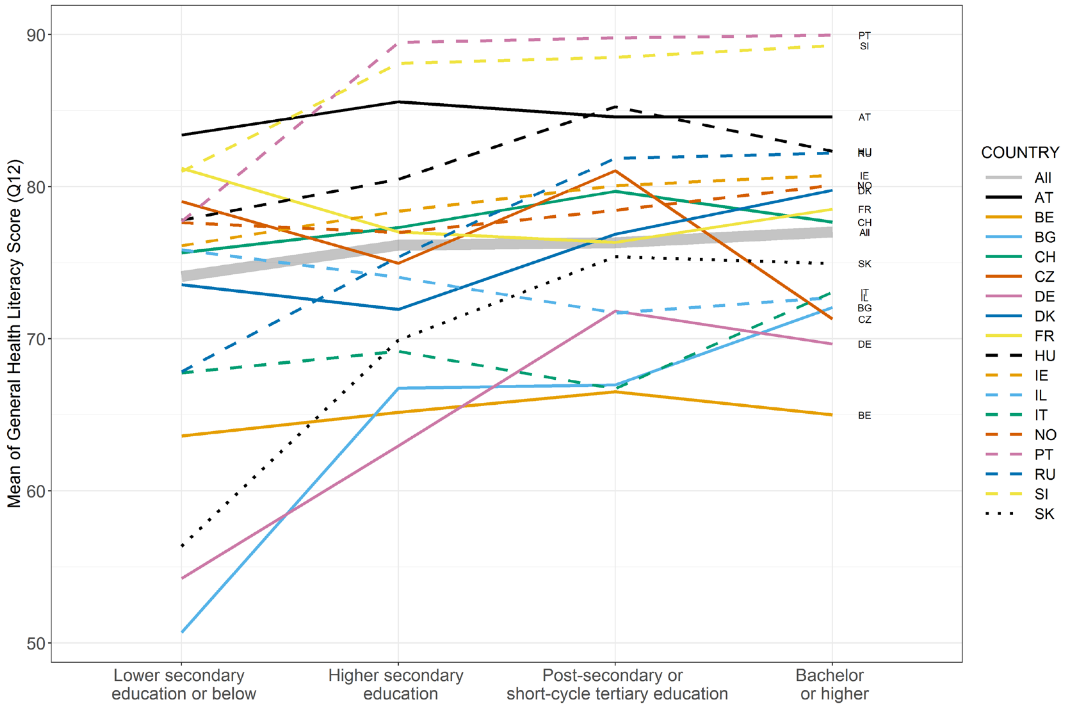
Table 6.4:
Means, standard deviations, and percentiles of distribution of educational levels (nine ISCED categories*), for each country and for all countries (equally weighted)

	AT	BE	BG	CH	CZ	DE	DK	FR	HU	IE	IL	IT	NO	PT	RU	SI	SK	All
Mean	3.8	5.2	5.3	4.2	3.3	4.0	4.9	5.0	3.0	3.9	4.5	3.2	4.8	3.1	4.5	3.4	4.3	4.1
SD	1.7	1.9	2.1	1.9	1.9	1.7	1.6	1.5	1.8	2.0	1.6	1.9	1.9	2.1	1.3	2.0	2.1	2.0
25th percentile	3.0	4.0	3.0	3.0	2.0	3.0	4.0	4.0	2.0	2.0	3.0	2.0	3.0	2.0	4.0	2.0	3.0	3.0
50th percentile	3.0	4.0	6.0	3.0	3.0	3.0	5.0	5.0	2.0	4.0	4.0	3.0	6.0	3.0	4.0	3.0	3.0	4.0
75th percentile	5.0	7.0	7.0	6.0	3.0	6.0	6.0	6.0	3.0	6.0	6.0	3.0	6.0	6.0	6.0	5.0	7.0	6.0

* Nine ISCED categories: from 0=no formal education or below ISCED 1 to 8=doctoral or equivalent level

Source: HLS19 Consortium

Figure 6.9:
Means of GEN-HL scores by education level (four grouped categories), for each country and for all countries (equally weighted)



Source: HLS19 Consortium

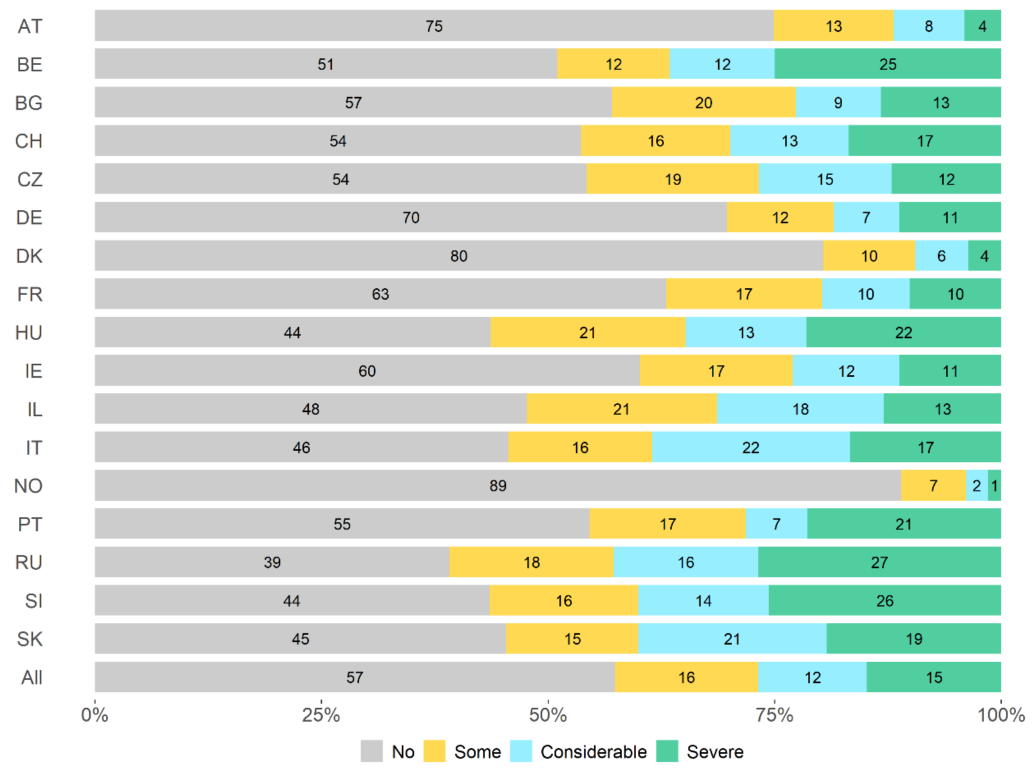
Financial deprivation

In the HLS19, the financial deprivation score was based on three items (for details on calculating the score, see Section 4.6). Compared to the HLS-EU, the three items used in the HLS19 were rephrased and for one item the categories were changed (D14 in the HLS-EU, corresponding to C-DET11 in the HLS19). For a detailed description of the items in the HLS19 in comparison with the HLS-EU, see Annex 6, Table 6.1.

The skewed and varying percentage distribution by country, with RU (followed by HU and SI) and NO (followed by AT) being the poles, is presented in Figure 6.10.

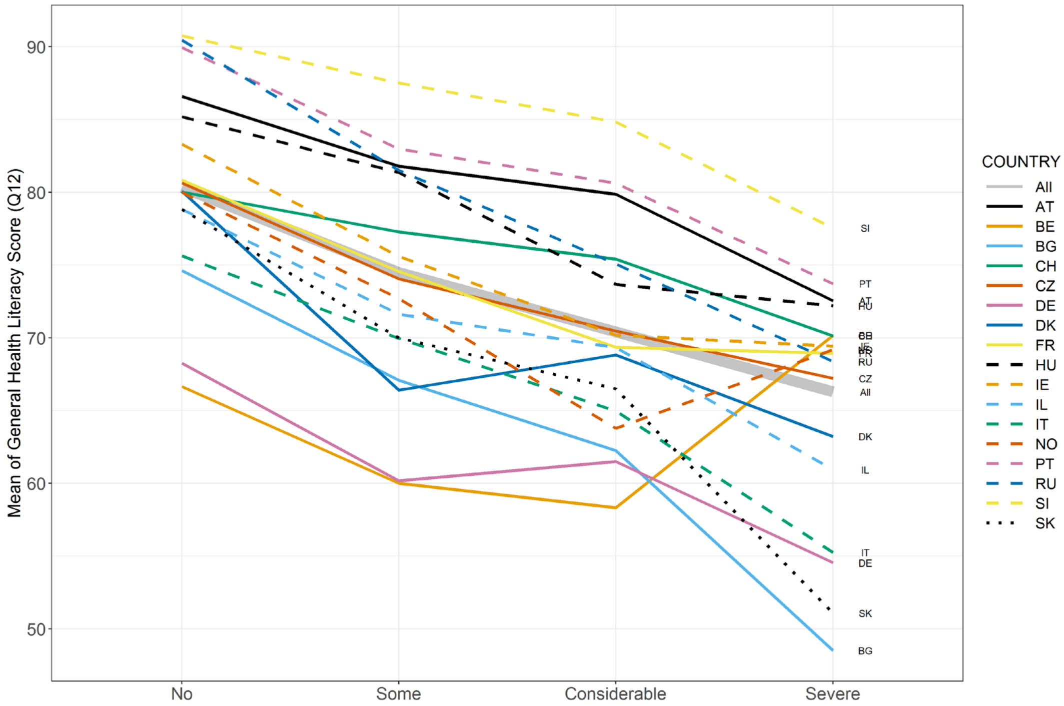
There is a negative correlation between General HL and financial deprivation, with an average value of ρ=-0.22, varying from ρ=-0.16 (CH, NO) to ρ=-0.41 (RU) and with ρ=0 for BE (Table 6.1). Apart from BE, which deviates from all other countries in the category of severe financial deprivation, the association is rather linear, but on a different level of General HL (Figure 6.11). (For NO, where only a low number of cases exist for severe deprivation, the mean value for this category may be unreliable) (Figure 6.10).

Figure 6.10.:
Percentage distribution of financial deprivation levels, for each country and for all countries (equally weighted)



Source: HLS19 Consortium

Figure 6.11:
Means of GEN-HL scores by financial deprivation level, for each country and for all countries (equally weighted)



Source: HLS19 Consortium

6.2.3 Further determinants: Migration background, long-term illness, training in a healthcare profession, and status of employment

Further determinants, which were partly used in the HLS-EU and other studies, were also explored. The results are presented below in relation to migration background, long-term illness, training in a healthcare profession, and partly for the status of employment.

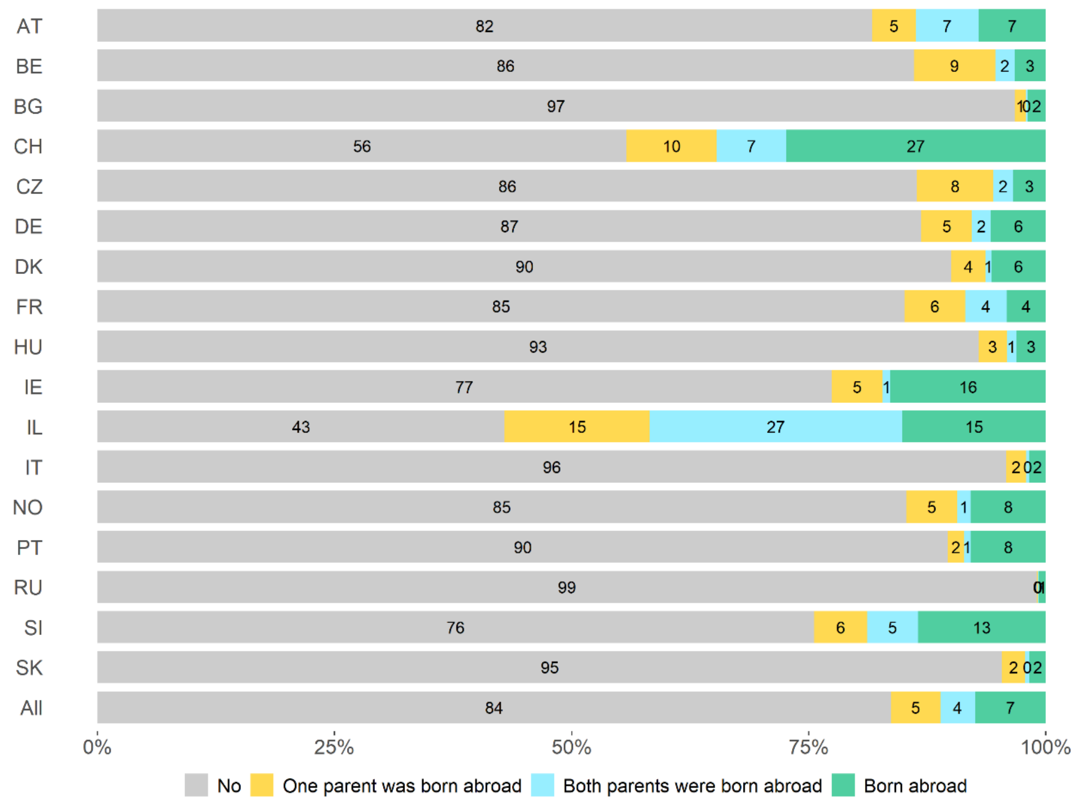
Migration background

In the HLS19, all permanent residents living in private households were included and, thus, in principle, all kinds of migrants, in contrast to the HLS-EU, where only EU citizens were included in the definition of the population. However, it should be noted that the HLS19 was only implemented in the national language(s) of participating countries and was not translated into migrant languages. Therefore, and also partly due to the method of data collection, migrants may be underrepresented. Only two countries (DE, NO) implemented a separate survey in parallel to the HLS19 which addressed migrants with the HLS_{19} instruments in migrant languages, but these results are not presented in the International Report.

While the HLS-EU only focused on parents' migration status, in the HLS_{19} this concept was widened, with migration background being measured by three questions in combination with an index of four categories: "none", "one parent was born abroad", "both parents were born abroad", and "born abroad". Figure 6.12 presents the percentage distributions of these four categories. In most countries, only a small proportion of respondents had a migration background: The lowest percentages on migration background were found in BG, HU, IT, RU, and SK. In contrast, for four countries, more than a fifth of the respondents had some form of migration background, from 23% (IE), 24% (SI), and 44% (CH) to 57% (IL).

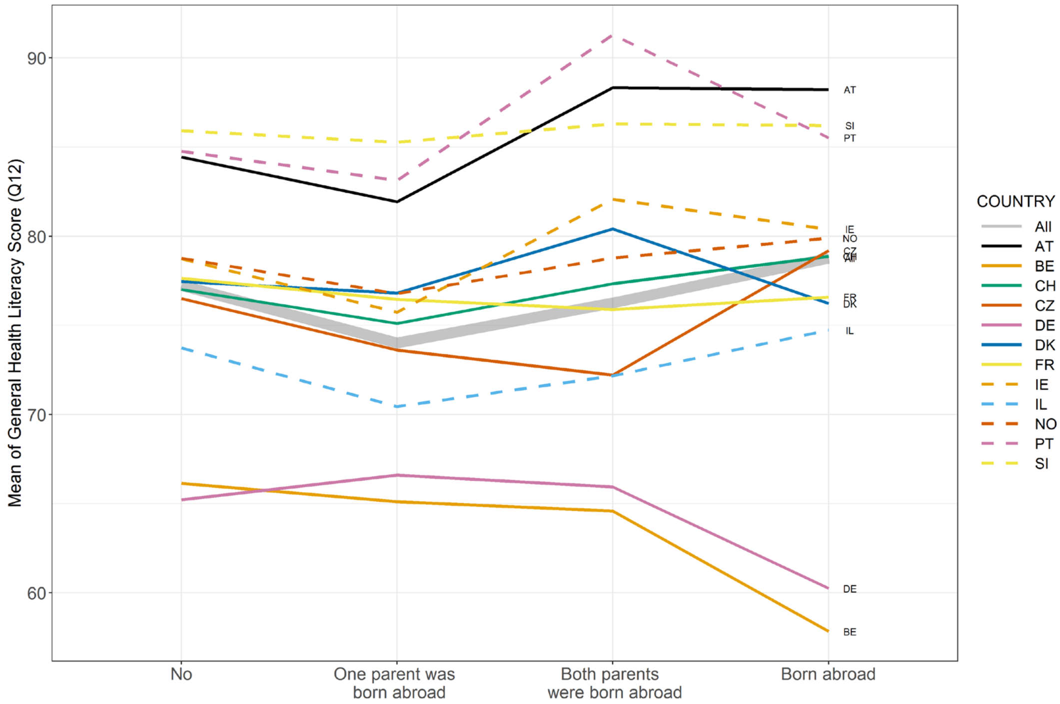
To examine the association of General HL by migration background, only countries with more than 10% of migrant respondents were included in the analyses (thereby excluding BG, HU, IT, RU, and SK). For most countries, the association of migration status with General HL is not linear (Figure 6.13). The overall correlation (with all countries weighted equally) is $\rho=0.01$, resulting from partly negative and partly positive values depending on the country (Table 6.1). Therefore, migration status was not included in the main model but was included in an additional regression model (Table 6.6).

Figure 6.12:
Percentage distribution of migration background, for each country and for all countries (equally weighted)



Source: HLS19 Consortium

Figure 6.13:
Means of GEN-HL scores by migration background, for each country and for all countries (equally weighted)



* Data from BG, HU, IT, RU, and SK were excluded as the percentage of respondents with a migration background was below 10%.

Source: HLS19 Consortium

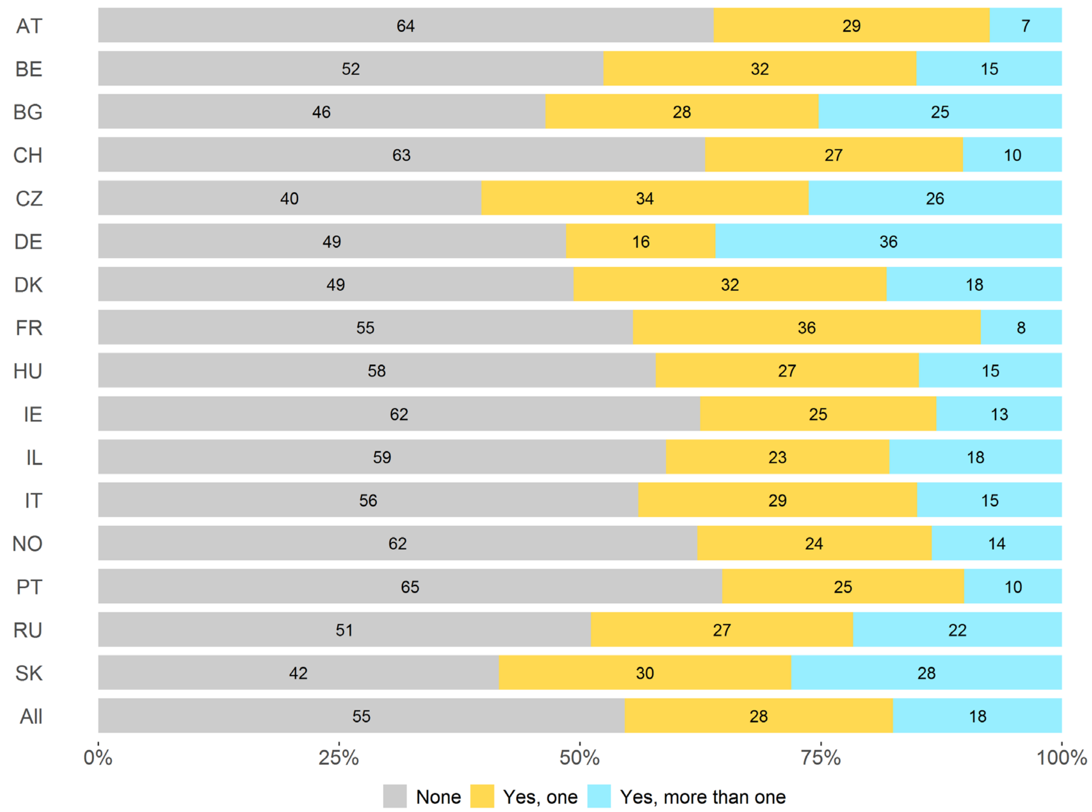
Long term-illness

Long-term illness was not included when analyzing social gradients of HL but it can be expected to be a relevant determinant of HL due to increased experience with the healthcare system. Therefore, it was tested in an additional regression model but not included in the main model (Table 6.7).

Long-term illness was measured by an item from the Minimum European Health Module (MEHM), asking respondents if they have any long-term illnesses or health problems that have lasted or are expected to last for six months or more. Three answer options were offered: (1) “no”, (2) “yes, one” or (3) “yes, more than one long-term illness or health problem”. (In one country (SI), answer options (2) and (3) were merged). These three categories were interpreted as being ordinal.

Overall, 55% of the respondents had no long-term illness, varying from 40% (CZ) to 64% (AT), 28% had one long-term illness (from 16% (DE) to 36% (FR)), and 18% (from 7% (AT) to 36% (DE)) had more than one long-term illness (Figure 6.14). The association of General HL with the number of long-term illnesses is negative and rather linear with only a few exceptions (Figure 6.15). The overall correlation is ρ=-0.14, varying from ρ=-0.03 (BE, CZ) to ρ=-0.28 (RU) (Table 6.1). Respondents with more than one chronic illness had lower HL than respondents with one or no chronic illnesses.

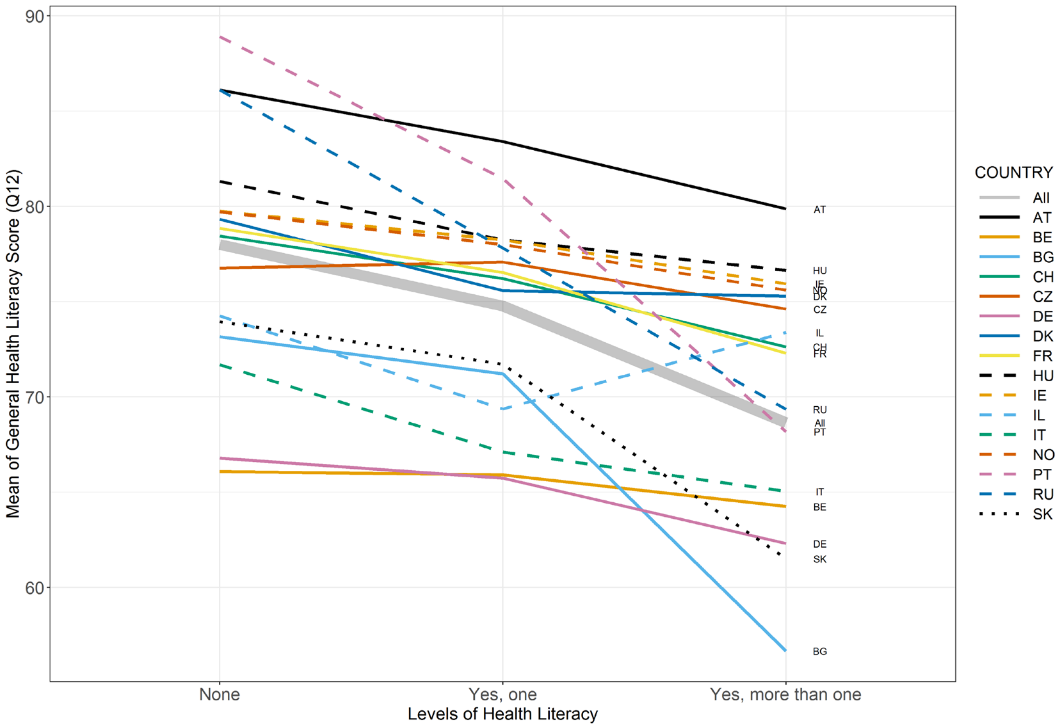
Figure 6.14:
Percentage distribution of the number of long-term illnesses/health problems, for each country and for all countries (equally weighted)



* SI was not included in Figure 6.13 as it used a slightly different measure with only two categories for long-term illnesses/health problems ((1) no and (2) one or more long-term illnesses/health problems). In SI 60% of the respondents had no long-term illnesses/health problems and 40% had one or more long-term illnesses/health problems.

Source: HLS_{19} Consortium

Figure 6.15:
Means of GEN-HL scores by the number of long-term illnesses/health problems, for each country and for all countries (equally weighted)



* SI was not included in Figure 6.14 as it used a slightly different measure with only two categories for long-term illnesses/health problems ((1) none and (2) one or more). In SI the mean GEN-HL for (1) "none" was 88.4 and for (2) "yes, one or more" it was 82.3.

Source: HLS19 Consortium

Training in a healthcare profession

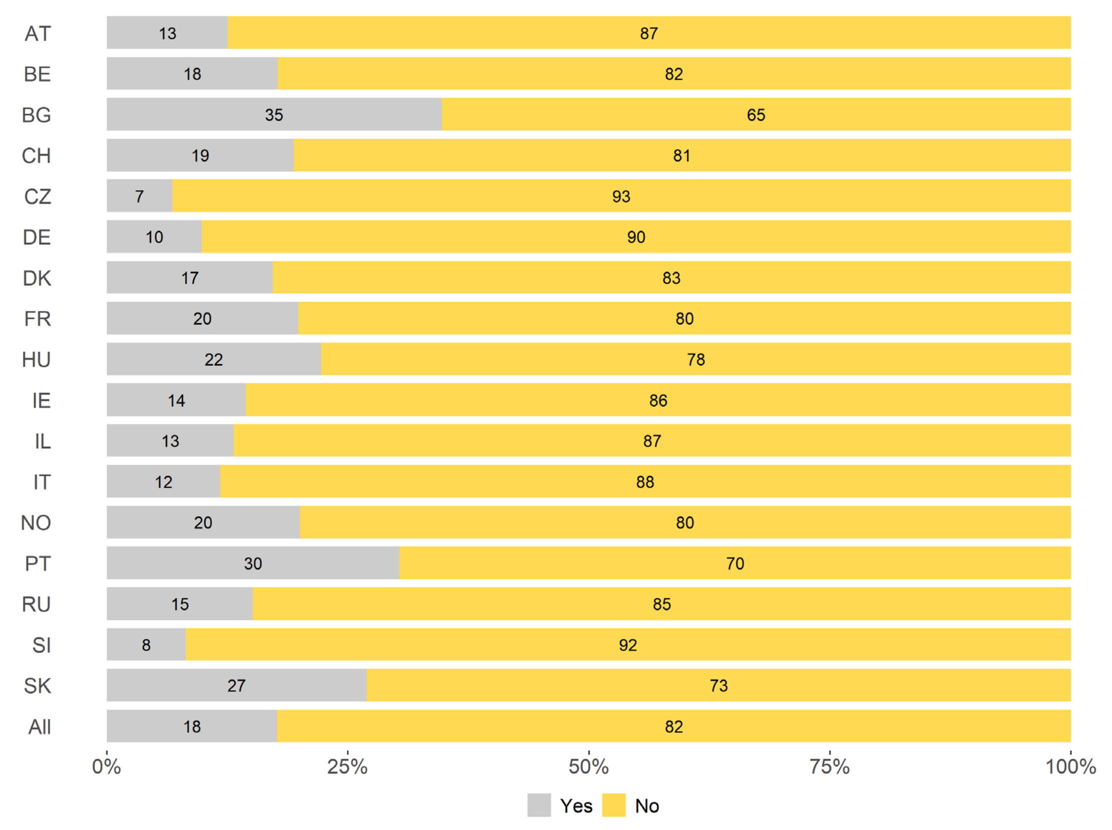
There is no tradition of using "training in a healthcare profession" in HL research or as a determinant of HL, but it was used in the HLS-EU and revealed interesting results. Therefore, it was included in the HLS19 and tested as a possible determinant in a specific model in this chapter since it could be argued that respondents trained as health professionals should have better HL (Table 6.8).

Training in a healthcare profession was measured by asking respondents: 'Have you ever been trained in a healthcare profession?', a slightly rephrase of the one used in the HLS-EU.

On average, nearly one-fifth of the respondents had experienced training in a healthcare profession, but there was considerable variation from 7% (CZ) to 35% (BG) (Figure 6.16). For all countries except AT, respondents with training in a healthcare profession had a higher mean value for General HL than those without but to a different degree and on a different level of HL (Figure 6.17).

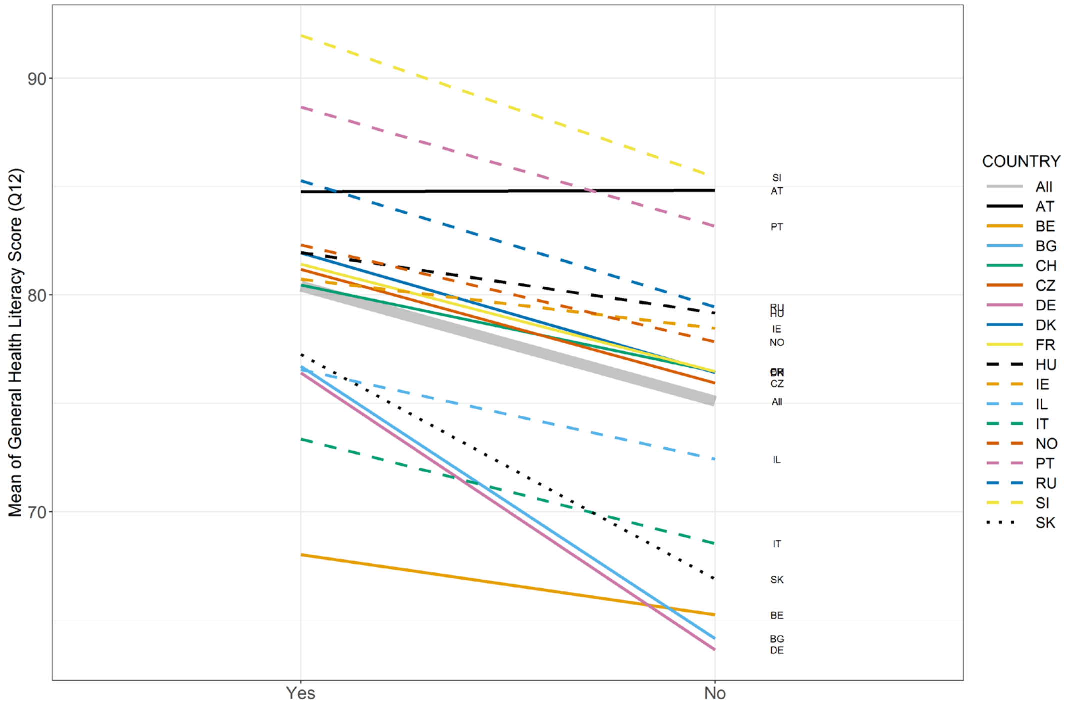
The correlations between HL and having "training in a healthcare profession" are comparatively high, with, on average, ρ=−0.10, varying from ρ=−0.04 (IE) to ρ=−0.29 (BG). The one exception was AT (0.01) where respondents trained in a healthcare profession had lower HL. (Table 6.1).

Figure 6.16:
Percentage distribution of training in a healthcare profession, for each country and for all countries (equally weighted)



Source: HLS_{19} Consortium

Figure 6.17:
Mean of GEN-HL scores by training in a healthcare profession, for each country and for all countries (equally weighted)



Source: HLS19 Consortium

Status of employment

Due to its nominal categorization, just the distributions (Figure A 6.1) and means of General HL for the status of employment categories (Table A 6.2) are presented in Annex 6 and no correlations or regressions. On average, 51% of the respondents were employed (varying from 36% (IT) to 60% (RU)) and 24% (from 15% (IL) to 31% (SI)) were retired; of the remainder, 7% were self-employed, 7% students or trainees, 5% unemployed, 3% did domestic work, and 2% were unable to work due to long-standing health problems. General HL was on average highest for those in employment (78.7) and lowest for the group of respondents who were unable to work due to long-standing health problems (71.4) (Annex 6, Table A 6.2).

6.3 Regression analyses

One of the research questions asked whether there is a social gradient for General HL and how strong the included determinants are as predictors of General HL. To answer this question, multivariable linear regression models were calculated. R^2 is used as a measure of model performance. Standardized coefficients (β) are used to compare the predictors' relative importance for each country (Table 6.5 to Table 6.8). The unstandardized coefficients (b) can be found in Annex 6, along with the results of regression analyses of linear models with ordinal variables entered as dummy variables (see Section 4.6 for methodological details).

6.3.1 Base model 1: Effects on HL of three measures of socio-economic status, gender, and age

Model 1 – using five selected core socio-demographic and socio-economic determinants of HL simultaneously – is the main model (and is also, in principle, comparable to the HLS-EU) to test for a social gradient of HL (Table 6.5). Judged by the values of R^2, the social gradient defined by the determinants included in this model is 7% on average. However, for individual countries, this value varies considerably from 4% (BE, CH, and NO) to 25% (BG).

On average, financial deprivation is the predictor with the highest average β of -0.21 and is also highest in each country, except for BE (where the relation with +0.05 is reversed), varying from β=-0.15 (CH, DE, FR, and NO) to β=-0.32 (SK). The second highest predictor is level in society, with β=0.1 on average (varying from 0.01 (AT, HU, and IT) to 0.26 (BG)).

For gender, those countries where being a woman predicts better General HL, β=0.04 on average, varying from 0.01 (CH) to 0.09 (CZ). The exceptions are HU (β=-0.03) and PT (β=-0.07) (both non-significant), where being a man predicts better General HL.

While the effects of the three determinants financial deprivation, level in society, and gender are rather similar across all countries (with a few exceptions), the effects for age (β=-0.04 for all countries) and education (β=-0.04 for all countries) are inconsistent across countries.

On average, a relevant social gradient for General HL was demonstrated for the combined five core socio-demographic and socio-economic determinants, with the highest effects for financial deprivation and level in society but differing considerably by country.

Table 6.5:
Model 1: Multivariable linear regression models of GEN-HL by five core social determinants (standardized coefficients (β) and R^2), for each country and for all countries (equally weighted)

	AT	BE	BG	CH	CZ	DE	DK	FR	HU	IE	IL	IT	NO	PT	RU	SI	SK	All
Gender female	**0.07**	0.02	0.03	0.01	**0.09**	**0.07**	**0.06**	0.04	−0.03	**0.06**	**0.07**	**0.05**	**0.07**	−0.07	**0.04**	0.03	**0.07**	**0.04**
Age in years	**−0.08**	0.03	**−0.08**	0	**0.11**	**−0.1**	**0.07**	0	**0.11**	**0.06**	**0.09**	**−0.05**	0	**−0.15**	**−0.15**	**−0.13**	**−0.11**	**−0.04**
Education	−0.03	−0.06	**0.11**	−0.02	**−0.14**	**0.13**	0.03	−0.04	0.03	**0.05**	**−0.09**	0.01	0.04	0.08	0.03	0.03	0.04	**−0.04**
Level in society	0.01	**0.2**	**0.26**	**0.08**	**0.13**	**0.09**	**0.1**	**0.14**	0.01	**0.11**	**0.14**	0.01	**0.08**	**0.11**	**0.16**	**0.09**	**0.16**	**0.10**
Financial deprivation	**−0.21**	0.05	**−0.18**	**−0.15**	**−0.21**	**−0.15**	**−0.19**	**−0.15**	**−0.28**	**−0.24**	**−0.21**	**−0.27**	**−0.15**	**−0.18**	**−0.27**	**−0.2**	**−0.32**	**−0.21**
R^2	0.05	0.04	0.25	0.04	0.1	0.09	0.08	0.06	0.09	0.1	0.1	0.08	0.04	0.15	0.22	0.1	0.21	0.07
Valid count	2694	988	724	2020	1568	1847	3563	2003	1124	4301	1156	3248	2682	1168	5138	3187	1800	
Total count	2967	1000	865	2502	1599	2143	3602	2003	1195	4487	1315	3500	2855	1247	5660	3360	2145	

Coefficients with p-values lower than 0.01 in bold.
Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of −0.005 to +0.005.
Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

Source: HLS_{19} Consortium

6.3.2 Model 2: Effects on HL of migration background, three measures of socio-economic status, gender, and age

In Model 2, in addition to the five core socio-demographic and socio-economic determinants, migration background was included (Table 6.6). As in Model 1, R^2, on average, explains just 7% of the variation in General HL, with the same range (between 4% (BE, CH, and NO) and 25% (BG)) across countries. Migration on average has a low predicting value ($\beta=0.03$) for General HL. Still, there are a few countries where migration background is a significant or relevant predictor of HL and migrants having somewhat better HL: CH ($\beta=0.06$, but not improving R^2), AT ($\beta=0.05$, improving R^2 somewhat), while at least in two countries (IL: $\beta=-0.06$, but not improving R^2; DE: $\beta=-0.04$, not improving R^2), migrants seem to have slightly lower HL for the given data. Thus, on average the same relevant social gradient for General HL was demonstrated for the combined five socio-demographic and socio-economic determinants with migration background added, with the highest effects for financial deprivation and level in society but differing considerably by country. Migration background did not improve the variance explained by the model and had, on average, no relevant effect on General HL.

Table 6.6:
Model 2: Multivariable linear regression models of GEN-HL by five core social determinants and migration background (standardized coefficients (β) and R^2), for each country and for all countries (equally weighted)

	AT	BE	BG	CH	CZ	DE	DK	FR	HU	IE	IL	IT	NO	PT	RU	SI	SK	All
Gender female	**0.07**	0.02	0.03	0.01	**0.09**	**0.08**	**0.06**	0.05	−0.03	**0.05**	**0.08**	**0.05**	**0.07**	−0.07	**0.04**	0.03	**0.07**	**0.04**
Age in years	**−0.06**	0.03	**−0.08**	0.01	**0.11**	**−0.11**	**0.07**	0	**0.12**	**0.06**	**0.12**	**−0.05**	0	**−0.15**	**−0.15**	**−0.13**	**−0.11**	**−0.04**
Education	−0.03	−0.06	**0.11**	−0.02	**−0.14**	**0.12**	0.03	−0.05	0.03	**0.05**	**−0.08**	0.01	0.04	0.08	0.02	0.03	0.04	**−0.04**
Level in society	0.01	**0.19**	**0.25**	**0.08**	**0.13**	**0.1**	**0.1**	**0.15**	0.01	**0.11**	**0.13**	0.01	**0.09**	**0.12**	**0.16**	**0.09**	**0.16**	**0.11**
Financial deprivation	**−0.21**	0.06	**−0.18**	**−0.16**	**−0.22**	**−0.15**	**−0.19**	**−0.15**	**−0.28**	**−0.24**	**−0.21**	**−0.27**	**−0.15**	**−0.18**	**−0.27**	**−0.2**	**−0.31**	**−0.21**
Migration background	**0.05**	−0.03	0	**0.06**	0.01	−0.04	0	−0.01	0.01	0.03	−0.06	0	0.03	0.01	0	0.02	−0.03	**0.03**
R^2	0.06	0.04	0.25	0.04	0.1	0.09	0.08	0.06	0.09	0.1	0.1	0.08	0.04	0.15	0.21	0.1	0.21	0.07
Valid count	2689	985	724	2009	1563	1822	3563	1969	1122	4277	1154	3248	2675	1168	5012	3164	1794	
Total count	2967	1000	865	2502	1599	2143	3602	2003	1195	4487	1315	3500	2855	1247	5660	3360	2145	

Coefficients with p-values lower than 0.01 in bold.
Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of −0.005 to +0.005.
In BG, HU, IT, RU, and SK, the percentage of respondents with migration background was below 10% so values on migration should be treated with caution.
Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).
Migration background: 0=none, 1=one parent born abroad, 2=both parents born abroad, 3=born abroad.

Source: HLS_{19} Consortium

6.3.3 Model 3: Effects on HL of long-term illness, three measures of socio-economic status, gender, and age

In Model 3, in addition to the five core socio-demographic and socio-economic determinants, long-term illnesses/health problems were included (Table 6.7). In this model explained R^2 is 8% on average, varying from 4% (BE, CH, and NO) to 25% (BG). Compared with Model 1, there are slight increases of explained R^2 in three countries, namely AT (from 5% to 6%), PT (from 15% to 18%), and RU (from 21% to 24%). Long-term illnesses/health problems have, on average, $\beta=-0.10$, which is, after financial deprivation ($\beta=-0.19$), the second strongest effect in the model. In all countries, respondents with at least one chronic disease still have lower General HL when other relevant predictors are controlled for, varying from $\beta=-0.02$ (BE) to $\beta=-0.20$ (PT).

By including long-term illnesses/health problems, the average β of financial deprivation, level in society, and age decreased slightly compared to Base Model 1 and Model 2 including migration. Thus, on average, the same relevant social gradient was demonstrated for General HL for the combined five socio-demographic and socio-economic determinants with long-term illnesses/health problems added. The highest effects were for financial deprivation and level in society, but they differed considerably by country. Long-term illnesses/health problems did not improve the explained variance in the model much but had, on average, the second highest significant effect on General HL.

Table 6.7:

Model 3: Multivariable linear regression models of GEN-HL by five core social determinants and long-term illness (standardized coefficients (β) and R^2), for each country and for all countries (equally weighted)

	AT	BE	BG	CH	CZ	DE	DK	FR	HU	IE	IL	IT	NO	PT	RU	SI	SK	All
Gender female	**0.07**	0.02	0.02	0.01	**0.09**	**0.07**	**0.06**	0.04	−0.02	**0.06**	**0.07**	**0.05**	**0.08**	−0.06	**0.05**	0.03	**0.07**	**0.04**
Age in years	**−0.06**	0.03	−0.06	0.02	**0.12**	**−0.08**	**0.09**	0.02	**0.13**	**0.07**	**0.11**	−0.04	0.01	−0.08	**−0.1**	**−0.11**	**−0.09**	−0.01
Education	−0.04	−0.06	**0.1**	−0.02	**−0.14**	**0.13**	0.03	−0.04	0.03	**0.05**	**−0.09**	0.01	0.04	**0.08**	**0.04**	0.03	0.03	**−0.04**
Level in society	0	**0.19**	**0.24**	**0.08**	**0.12**	**0.09**	**0.1**	**0.14**	0	**0.1**	**0.13**	0	**0.08**	**0.1**	**0.14**	**0.09**	**0.16**	**0.09**
Financial deprivation	**−0.2**	0.06	**−0.18**	**−0.14**	**−0.21**	**−0.15**	**−0.18**	**−0.14**	**−0.26**	**−0.23**	**−0.2**	**−0.27**	**−0.14**	**−0.15**	**−0.26**	**−0.19**	**−0.31**	**−0.19**
Long-term illness	**−0.08**	−0.02	−0.07	**−0.06**	−0.05	−0.03	**−0.07**	**−0.06**	−0.07	**−0.04**	−0.05	−0.04	−0.04	**−0.2**	**−0.12**	**−0.07**	−0.05	**−0.10**
R^2	0.06	0.04	0.25	0.04	0.1	0.09	0.08	0.06	0.09	0.1	0.1	0.08	0.04	0.18	0.24	0.11	0.21	0.08
Valid count	2686	988	705	2017	1568	1821	3557	2003	1121	4291	1155	3185	2663	1163	4910	3183	1774	
Total count	2967	1000	865	2502	1599	2143	3602	2003	1195	4487	1315	3500	2855	1247	5660	3360	2145	

Coefficients with p-values lower than 0.01 in bold.

Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of −0.005 to +0.005.

Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).

Level in society from 1=lowest level to 10=highest level in society.

Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

Long-term illness: 3 categories: (1) none, (2) one, (3) more than one, except for SI where 2 categories were used (1) none, (2) one or more.

Source: HLS_{19} Consortium

6.3.4 Model 4: Effects on HL of training in a healthcare profession, three measures of socio-economic status, gender, and age

In Model 4, in addition to the five core socio-demographic and socio-economic determinants, training in a healthcare profession was included (Table 6.8). As in Models 1 and 2, in this model just 7% of General HL is explained on average, varying between 4% (BE) and 27% (BG). Again, after financial deprivation (β=-0.21) and level in society (β=0.1), training in a healthcare profession is the third strongest predictor in the model with an average of β=-0.08. In all but one country (AT), respondents with training in a healthcare profession have higher HL when other relevant predictors are controlled. The strength of this effect varies from β=-0.02 (IE) to β=-0.16 (BG). Thus, on average, the same relevant social gradient for General HL was demonstrated for the combined five socio-demographic and socio-economic determinants plus training in a healthcare profession, with the highest effects for financial deprivation, and level in society, but differing considerably by country. Training in a healthcare profession did not improve the variance explained by the model but it had on average the third strongest significant effect on General HL.

Table 6.8:

Model 4: Multivariable linear regression models of GEN-HL by five core social determinants and training in a healthcare profession (standardized coefficients (β) and R^2), for each country and for all countries (equally weighted)

	AT	BE	BG	CH	CZ	DE	DK	FR	HU	IE	IL	IT	NO	PT	RU	SI	SK	All
Gender female	**0.07**	0.02	0	−0.01	**0.09**	0.05	0.04	0.04	−0.03	**0.05**	0.07	**0.05**	**0.05**	**−0.07**	**0.03**	0.03	0.05	**0.03**
Age in years	**−0.08**	0.03	−0.06	0.01	**0.10**	**−0.09**	**0.07**	0.01	**0.11**	**0.06**	**0.10**	−0.05	0	**−0.15**	**−0.14**	**−0.13**	**−0.11**	**−0.04**
Education	−0.04	−0.06	0.07	−0.03	**−0.15**	**0.11**	0.02	−0.05	0.03	**0.05**	**−0.10**	0.01	0.03	0.08	0.02	0.03	0.01	**−0.05**
Level in society	0.01	**0.20**	**0.24**	**0.08**	**0.13**	**0.10**	**0.11**	**0.13**	0	**0.11**	**0.13**	0	**0.08**	**0.11**	**0.16**	**0.09**	**0.16**	**0.10**
Financial deprivation	**−0.21**	0.05	**−0.18**	**−0.15**	**−0.21**	**−0.14**	**−0.19**	**−0.15**	**−0.28**	**−0.24**	**−0.21**	**−0.27**	**−0.14**	**−0.18**	**−0.27**	**−0.20**	**−0.31**	**−0.21**
No training in a health profession	0	−0.04	**−0.16**	**−0.07**	−0.06	**−0.15**	**−0.09**	**−0.08**	−0.04	−0.02	−0.06	−0.04	**−0.06**	−0.05	**−0.08**	−0.04	**−0.11**	**−0.08**
R^2	0.05	0.04	0.27	0.04	0.1	0.11	0.09	0.06	0.09	0.1	0.1	0.08	0.05	0.16	0.22	0.11	0.22	0.07
Valid count	2678	988	718	2020	1568	1842	3560	2003	1123	4295	1156	3248	2676	1168	5116	3184	1783	
Total count	2967	1000	865	2502	1599	2143	3602	2003	1195	4487	1315	3500	2855	1247	5660	3360	2145	

Coefficients with p-values lower than 0.01 in bold.

Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of −0.005 to +0.005.

Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).

Level in society from 1=lowest level to 10=highest level in society.

Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

Source: HLS_{19} Consortium

6.4 Discussion and conclusions

The focus of this chapter is on two research questions: (1) Is there a social gradient for General HL? and (2) How strong are potential effects of selected determinants on General HL?

In summary, the HLS_{19} demonstrated a weak social gradient for General HL in a model combining the five core socio-demographic and socio-economic determinants (gender, age, education, level in society, and financial deprivation), with financial deprivation showing the strongest negative effects and level in society the strongest positive effects. The magnitude of the explained variance and regression coefficients varied considerably across countries, though. Inclusion of migration background, long-term illnesses/health problems or training in a healthcare profession did not improve model performance, but long-term illnesses/health problems and training in a healthcare profession showed the third highest effect on General HL, after financial deprivation and level in society.

Limitations: Due to the limited standardization of the HLS_{19} study design (mainly the type and time of data collection), alongside overall trends and the range in variation in the measured values across countries, comparisons of the results between individual countries have not been described or interpreted in the International Report; differences in the results of countries must be interpreted with caution. Furthermore, due to the cross-sectional design of the study, the causal assumptions underlying the specified regression models may not be met.

Comparison with the results of the HLS-EU is further limited by changes in the measure of General HL, by changes in the measures of selected determinants, by changes in the method of data collection, and by different countries being included in the two studies.

In contrast to the HLS-EU study, although the same independent variables were used in principle, the explained variance in the base model, i.e., the strength of the social gradient, is considerably lower at 7% vs. 17% in the HLS-EU study, but the range of variation for the explained variance across countries is, from 4% (BE, CH, and NO) to 25% (BG), rather similar to the HLS-EU, which ranged from 8% (NL) to 29% (GR). In both studies, financial deprivation (ß=−0.21 vs. ß=−.24 in the HLS-EU study) and level in society (ß=+0.1 vs. ß=+0.14 in the HLS-EU study) have the strongest effects for the mean of all countries but with somewhat smaller values for the HLS_{19}. In contrast to the HLS-EU and other studies, education had, on average, with ß=−0.04, much smaller but opposite effects across countries (positive effects for 11 countries, statistically significant for three countries; negative effects for six countries, statistically significant for three countries). Age, too, had, on average, with ß=−0.04, much smaller and opposite effects for countries compared to the HLS-EU (0 for three countries; significant negative effects for eight countries; positive effects for six countries, significant for five). For the female gender the effect was, on average, small but statistically significant (ß=0.04): in 15 countries women had higher General HL than men (statistically significant in 11 countries) and in two countries it was the opposite (but not statistically significant).

The differences found are probably due mostly to methodological differences in the two studies and cannot be attributed to real changes in HL over time in European countries.

Conclusions

In the HLS_{19}, which involved more and partly different countries in the WHO European Region, a social gradient for HL was demonstrated. This adds to the existing evidence that HL is a relevant factor for public health policy in all participating countries.

Financial deprivation was demonstrated as the strongest predictor of General HL in all countries, followed by level of society. There was a trend for higher General HL in women, but the results for age and education were inconsistent across countries. Further research is needed to investigate these inconsistent results.

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7 General Health Literacy as a predictor of health behaviors and lifestyles

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7.1 Background

Previous research

The association of HL with different indicators of health or lifestyle-related behaviors has been researched and presented, especially for certain indicators, in international publications and in the HLS-EU and its follow up studies; therefore, relevant research questions have been included in the HLS_{19} as well. These research questions on identifying the relevance of HL for health and health policy focus on establishing whether HL has a significant effect on these behaviors and not on explaining the variance of these behaviors. The HLS_{19} is interested in the effects of HL and not in these behaviors specifically.

Previous research showed that higher functional HL increases the likelihood of pursuing health-promoting behaviors such as eating fruit and vegetables, being a non-smoker, and having a better health perception, when controlling for socio-demographic and socio-economic data (Von Wagner et al. 2007). Already the original HLS-EU study, and also some of its follow-up studies to a certain extent, demonstrated significant Spearman correlations for HL with some behaviors. These correlations were highest for physical activity (more physical activity/higher HL; ρ=-.19, variation across countries from ρ=-.04 to ρ=-.21), followed by BMI (lower BMI/higher HL; ρ=-.07, variation from ρ=.03 to ρ=-.13 but significant only in four (AT, DE, EL, and PL) out of the eight countries). The picture was not so clear for alcohol consumption (the more “light” and the less “no” alcohol consumption/higher HL; ρ=.07, significant only in 3 (ρ=.07 (PL), ρ=.10 (BG), ρ=.16 (EL)) out of the eight countries) and for smoking behavior (ρ=-.01, not significant on average, inconsistent for sign of correlation across countries, and significant only in four (ρ=.13 (BG), ρ=.09 (EL), ρ=-.08 (DE/NRW), -.09 (IE)) out of the eight countries) (HLS-EU-Consortium 2012; Pelikan/Ganahl 2017b). Using multivariable linear regression analyses in models that explained on average 8% (varying across countries from 1% to 10%) for physical activity, it was demonstrated that HL had on average the highest significant effect with β=-.13 (varying across countries from β=-.06 to β=-.18) (Pelikan/Ganahl 2017b).

Later studies also showed that individuals with adequate levels of self-reported HL were more likely to be involved in physical activity (Fernandez et al. 2016) and better HL was also associated with greater fruit and vegetable intake (Lim et al. 2017). Low levels of HL, in contrast, are associated with physical inactivity, unhealthy dietary habits, underweight and obesity, and daily smoking (Aaby et al. 2017). Similar findings concerning the level of physical activity and body weight were obtained by Svendsen et al. (2020), who used the HLS-EU-Q16 for measuring HL. Thus, there exist consistent results for a positive effect of HL on physical activity and on dietary habits (fruit and vegetable intake) as well as BMI in most studies, but the results for alcohol consumption and smoking are inconsistent.

Health behaviors and lifestyles variables in the HLS_{19} in comparison with the HLS-EU

An influence of health behaviors and lifestyles on HL was hypothesized by the HLS_{19} study, thereby building on the HLS-EU study's conceptual model of HL (Sørensen et al. 2012) and the refined Vienna Model of Health Literacy (Pelikan/Ganahl 2017a) (see Figure 1.2, Chapter 1). The leading research question in the HLS_{19} was whether there is a relevant and significant effect of General HL on selected types of health behaviors and lifestyles (and not how variance in these behaviors can best be explained.) However, in a cross-sectional study like the HLS_{19}, this question can only be answered in a limited, explorative way because the underlying causal assumptions cannot be tested empirically with the existing set of data.

In the HLS_{19} four of the health behaviors and lifestyles variables which had already been used in the HLS-EU (albeit with somewhat different indicators) were implemented. Additionally, fruit and vegetable consumption was included as a further lifestyle variable. The precise wording of the items on health behaviors and lifestyles used in the HLS_{19}, the source of the original item, and indications of changes made relating to the item used in the HLS-EU are shown in Annex 7, Table A 7.1.

Summing up, the five variables used in the HLS_{19} were BMI, smoking behavior, alcohol consumption, physical activity, and fruit and vegetable consumption. Apart from BMI, their measurement was standardized as the number of days per week that respondents usually practice these behaviors, grouped as follows:

» never --> never
» less than one day per week & 1 day --> occasional use
» 2 days & 3 days --> light use
» 4 days & 5 days & 6 days & 7 days --> heavy use.

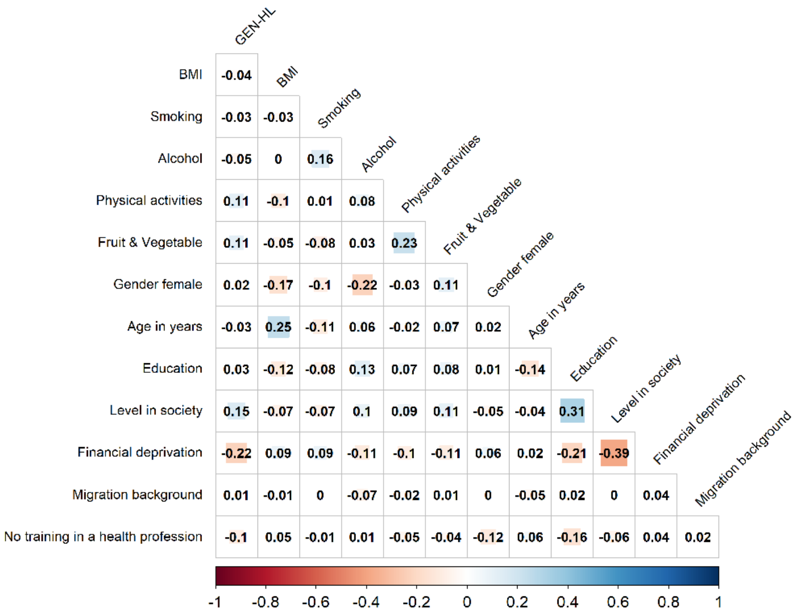
The data analyses and results are presented by:

» percentage distributions of health behaviors and lifestyles indicators (Annex 7),
» associations of health behaviors and lifestyles indicators with General HL (for all countries in the main chapter and for each country in Annex 7),
» Spearman correlations (ρ) among indicators of health behaviors and lifestyles, with General HL and selected socio-demographic and socio-economic determinants (for all countries in the main chapter and for each country in Annex 7),
» regression analyses: R^2 and β coefficients of multivariable linear regression models are used to compare the relative importance of the predictors included (results in the main chapter). In Annex 7 results on regression models with unstandardized coefficients (b) are also provided.

7.2 Spearman correlations among indicators of health behaviors and lifestyles, with General HL and selected socio-demographic and socio-economic determinants

Of the five indicators for health behaviors and lifestyles, physical activity and fruit and vegetable consumption are highest positively correlated (ρ=0.23), followed by smoking behavior and alcohol consumption (ρ=0.16) as well as alcohol consumption and physical activity (ρ=0.08). There were somewhat smaller and negative correlations between smoking behavior and fruit and vegetable consumption (ρ=−0.08) as well as between BMI and physical activity (ρ=−0.1), and BMI and fruit and vegetable consumption (ρ=−0.05) (Figure 7.1).

Figure 7.1:
Spearman correlations (ρ) among indicators of health behaviors and lifestyles, with GEN-HL, and selected socio-demographic and socio-economic determinants, for all countries (equally weighted)*



* Values for the correlations with migration should be treated with caution as in five countries (BG, HU, IT, RU, and SK) the percentage of respondents with a migration background was below 10%, and the HLS19 survey as such was not adjusted to targeting migrants specifically (e.g., by offering translations of the instrument into migrant languages).

Source: HLS19 Consortium

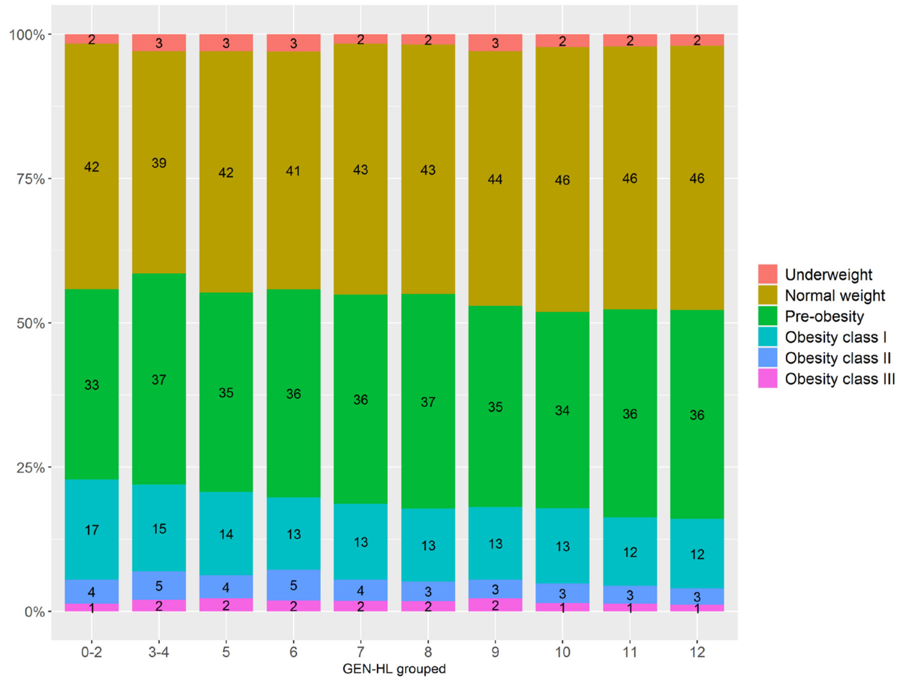
On average, General HL correlates positively with “fruit and vegetable consumption” (0.11) and “physical activity” (0.11), while just very weakly and negatively with “BMI” (-0.04), “alcohol consumption” (-0.05), and “smoking behavior” (-0.03) (Figure 7.1). In fact, these indicators of health behaviors and lifestyles mostly have a higher correlation with socio-demographic and socio-economic indicators than with General HL (Figure 7.1).

7.3 General HL and BMI

For BMI on average, 2% of the respondents (from 1% (DK, PT, and SI) to 4% (BG, FR)) were classified as underweight, 44% (from 33% (CZ) to 56% (CH)) as normal weight, 36% (29% (CH) to 44% (PT)) as pre-obese, 13% (from 9% (CH) to 19% (CZ)) as obese class I, 3% (from 1% (PT) to 6% (BE, CZ, HU)), as obese class II, and 2% (from 0% (SK) to 4% (DK) as obese class III. Thus, there is quite some variation across countries (Annex 7, Figure A 7.1).

On average there is a rather linear, slight, negative relationship between BMI and General HL while higher HL is associated with a decrease in the BMI group of obesity class I (Figure 7.2), but this relationship is rather different for individual countries (Annex 7, Figure A 7.2).

Figure 7.2:
Percentage distribution of six categories of BMI by GEN-HL (10 groups from lowest HL to highest HL), for all countries (equally weighted)



Source: HLS19 Consortium

BMI is mainly correlated with socio-demographic and socio-economic factors (Annex 7, Table A7.2), i.e.,

- » age (ρ=0.25, varying from 0.1 (DK) to 0.42 (RU, SK)),
- » female gender (ρ=−0.17, varying from -0.01 (IL) to -0.33 (BG)),
- » education (ρ=−0.12, varying from -0.02 (BG, NO) to -0.22 (PT),
- » financial deprivation (ρ=0.09 varying from 0.02 (CZ, NO) to 0.12 (CH)), and
- » level in society (ρ=−0.07, varying from -0.01 (IE) to -0.13 (SI)).

In contrast, there is only a very weak association with General HL (ρ=−0.04, varying from +0.02 (BE, IL) to -0.12 (SK)), but also for migration (on average ρ=−0.01 but varying inconsistently with positive or negative correlations for different countries) and for training as a healthcare profession (on average ρ=0.05, mostly with low positive correlations varying from 0.02 (DK, IE) to 0.13 (BG), but a few countries also have very low negative correlations). Therefore, migration and training as a health professional were not used in the regression analyses (Annex 7, Table A 7.2).

Using a multivarible linear regression model including the five core socio-demographic and socio-economic indicators and General HL as predictors and BMI as a dependent variable, on average just 5% of the variance is explained by the model (varying from 1% (IL) to 14% (RU)). With an average β=-0,01 (varying inconsistently on a low level for countries), General HL is the predictor with the lowest β in the model, after level in society (β=-0.03), education (β=0.05), financial deprivation (β=0.06), gender female (β=-0.11), and age (β=0.15) (Table 7.1). For the same model with unstandardized coefficients (b), see Annex Table A 7.3.

In conclusion, there is, on average, no relevant and significant effect of General HL on BMI, and such an effect is only demonstrated for a few countries.

Table 7.1:
Multivariable linear regression models of BMI by GEN-HL and five core social determinants (standardized coefficients (β) and R^2), for each country and for all countries (equally weighted)

	AT	BE	BG	CH	CZ	DE	DK	FR	HU	IE	IL	IT	NO	PT	RU	SI	SK	All
GEN-HL	**-0.06**	0.02	0	-0.06	-0.04	-0.04	**-0.06**	-0.01	-0.01	-0.04	-0.01	-0.03	-0.02	0.06	0	0.01	-0.03	**-0.01**
Gender female	**-0.19**	-0.05	**-0.2**	**-0.21**	**-0.12**	**-0.18**	**-0.05**	**-0.1**	**-0.16**	**-0.11**	0.06	**-0.13**	**-0.14**	**-0.12**	-0.02	**-0.1**	**-0.24**	**-0.11**
Age in years	**0.14**	**0.18**	**0.09**	**0.15**	**0.26**	**0.2**	**0.05**	**0.2**	**0.17**	**0.11**	**0.08**	**0.16**	**0.13**	**0.15**	**0.37**	**0.1**	**0.37**	**0.15**
Education	**-0.06**	**-0.1**	-0.02	**-0.06**	**-0.08**	-0.05	-0.04	-0.05	**-0.11**	-0.04	-0.03	-0.02	-0.04	**-0.12**	**-0.06**	**-0.07**	**-0.06**	**-0.05**
Level in society	**-0.05**	-0.06	-0.02	0.04	-0.04	-0.04	**-0.05**	-0.05	-0.02	0	-0.02	-0.04	**-0.07**	0	**-0.04**	-0.03	-0.01	**-0.03**
Financial deprivation	**0.09**	**0.09**	0.09	**0.15**	0.03	0.06	**0.1**	0.05	0.05	0.04	0.02	**0.1**	0.04	0.06	-0.03	0.03	-0.04	**0.06**
R^2	0.08	0.06	0.08	0.09	0.11	0.09	0.04	0.07	0.07	0.03	0.01	0.06	0.05	0.08	0.14	0.04	0.2	0.05
Valid count	2598	973	723	2007	1459	1726	3459	1892	1111	4002	1103	3229	2572	1167	4829	3138	1747	
Total count	2967	1000	865	2502	1599	2143	3602	2003	1195	4487	1315	3500	2855	1247	5660	3360	2145	

Coefficients with p-values lower than 0.01 in bold.
Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of -0.005 to +0.005.
BMI: used as continuous variable.
GEN-HL score: from 0=minimal HL to 100=maximal HL.
Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

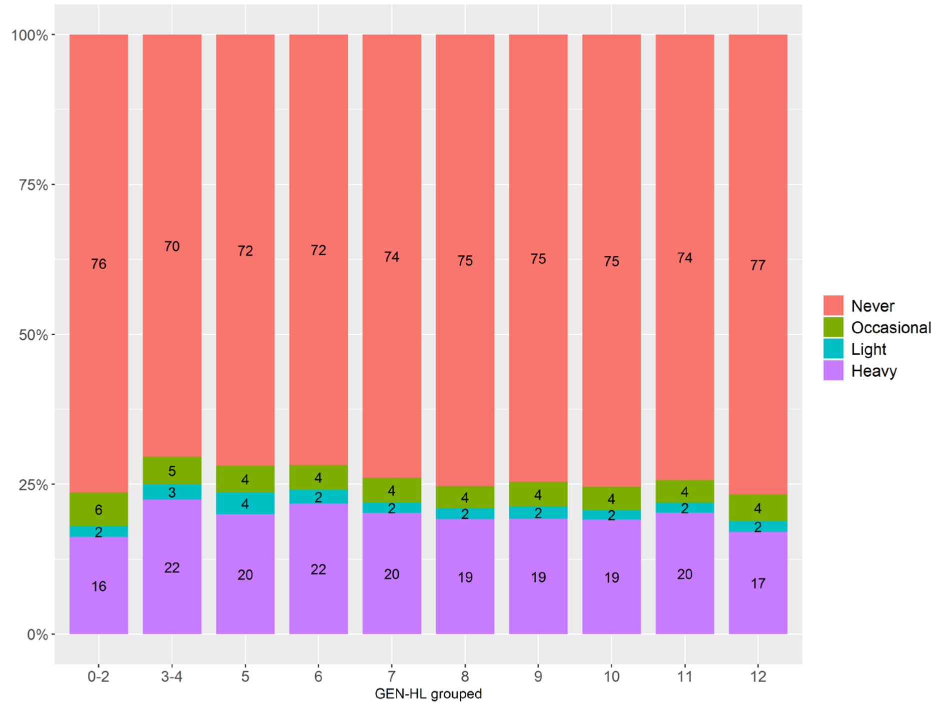
Source: HLS_{19} Consortium

7.4 General HL and smoking behavior

On average, taking the mean for all countries, 75% (from 59% (BG) to 86% (NO)) of respondents were classified as never smoking, 4% (from 2% (DE, HU) to 7% (IT)) as occasional smokers, 2% (from 0% (PT) to 4% IT)) as light smokers, and 19% (from 10% (NO) to 34% (BG) as heavy smokers. Thus, across countries there is considerable variation (Annex 7, Figure A 7.3).

On average, the association of the intensity of smoking behavior with General HL is very low, and rather negative (Figure 7.3). Respondents with higher General HL smoke somewhat less heavily, but the association differs widely across individual countries (Annex 7, Figure A 7.4).

Figure 7.3:
Percentage distribution of four categories of smoking behavior by GEN-HL (10 groups from lowest HL to highest HL), for all countries (equally weighted)



Source: HLS19 Consortium

On average with ρ=−0.03, General HL is very slightly correlated with smoking behavior, negatively for most countries and varying from ρ=−0.01 (BG) to ρ=−0.08 (HU), but for a few countries positively to ρ=0.08 (PT) and for two countries just with ρ=0 (FR, IL, SI). Thus, smoking behavior has a much lower correlation with General HL than with the socio-demographic and socio-economic indicators (Annex 7, Table A 7.4).

With, on average, R^2 of 4% (varying across countries from 1% (BG, FR) to 14% (RU)), the model explains even less variance than the model for BMI. The predictive value of General HL on average is β=0, due to inconsistent results across countries. Some countries show a negative β value from −0.01 (DK, HU, IE, and NO) to −0.06 (AT, SK) and a few countries even have a positive β value up to 0.09 (PT) (Table 7.2). (For the same model with unstandardized coefficients (b), see Annex Table A 7.5). Thus, no consistent and relevant effect of General HL on smoking behavior was determined for the countries on average, but there were opposite and significant effects in a few countries.

Table 7.2:
Multivariable linear regression models of <u>smoking behavior</u> by GEN-HL and five core social determinants (standardized coefficients (β) and R^2), for each country and for all countries (equally weighted)

	AT	BE	BG	CH	CZ	DE	DK	FR	HU	IE	IL	IT	NO	PT	RU	SI	SK	All
GEN-HL	**−0.06**	0	0.03	0.01	−0.03	−0.04	−0.01	0.02	−0.01	−0.01	0.04	**0.08**	−0.01	**0.09**	**−0.04**	0.04	−0.06	0
Gender female	**−0.12**	−0.07	−0.04	**−0.12**	**−0.13**	**−0.11**	0	−0.03	−0.07	−0.04	**−0.09**	**−0.08**	−0.03	**−0.19**	**−0.32**	**−0.08**	**−0.16**	**−0.1**
Age in years	**−0.12**	**−0.11**	−0.08	**−0.11**	**−0.12**	**−0.14**	−0.02	−0.05	**−0.22**	**−0.17**	**−0.16**	**−0.14**	**0.05**	**−0.1**	**−0.16**	**−0.2**	**−0.13**	**−0.12**
Education	**−0.1**	−0.06	−0.01	−0.04	**−0.19**	−0.04	**−0.06**	−0.04	**−0.09**	**−0.13**	**−0.18**	−0.04	**−0.11**	0	**−0.1**	**−0.12**	**−0.11**	**−0.08**
Level in society	**0.07**	−0.07	0.02	−0.05	−0.02	**−0.1**	−0.02	0	**−0.12**	**−0.07**	0.02	0	−0.05	−0.08	**−0.04**	−0.01	−0.02	**−0.03**
Financial deprivation	0.05	0	0.05	**0.13**	**0.07**	0.02	**0.12**	**0.1**	0.06	**0.13**	0.05	**0.13**	**0.12**	0.04	0.03	**0.08**	−0.04	**0.06**
R^2	0.05	0.03	0.01	0.06	0.06	0.05	0.03	0.01	0.08	0.07	0.07	0.05	0.04	0.06	0.14	0.06	0.06	0.04
Valid count	2691	988	715	2019	1567	1842	3539	2003	1124	4301	1155	3243	2680	1168	5081	3180	1791	
Total count	2967	1000	865	2502	1599	2143	3602	2003	1195	4487	1315	3500	2855	1247	5660	3360	2145	

Coefficients with p-values lower than 0.01 in bold.
Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of −0.005 to +0.005.
Smoking behavior: from (1) never to (4) heavy.
GEN-HL score: from 0=minimal HL to 100=maximal HL.
Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

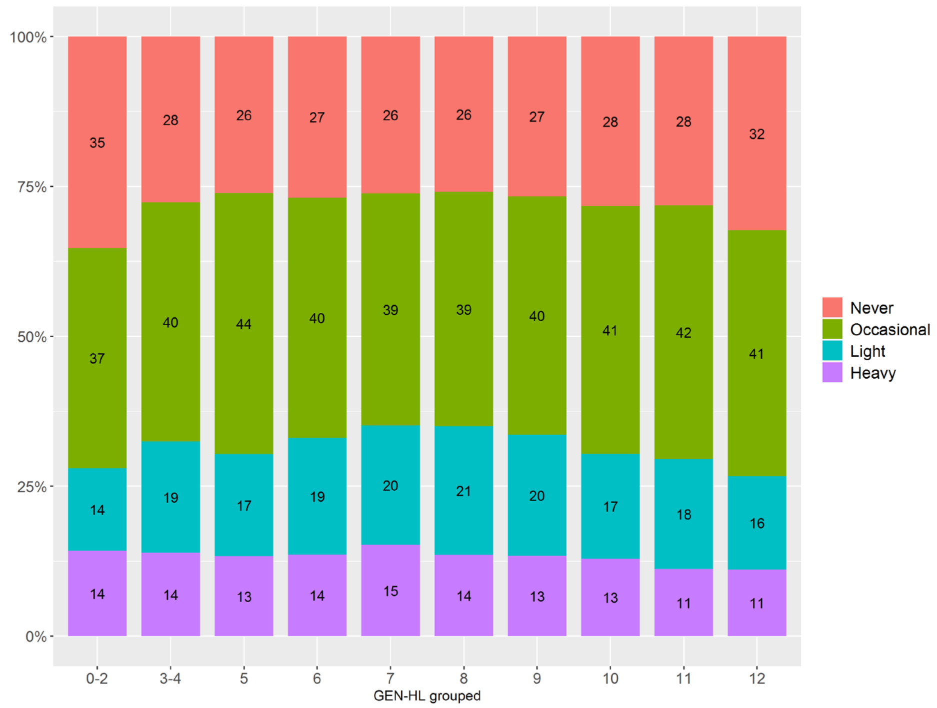
Source: HLS_{19} Consortium

7.5 General HL and alcohol consumption

On average 29% (from 8% (BG) to 52% (RU)) of the respondents were classified as never consuming alcohol, 41% (from 33% (IT) to 46% (NO, PT)) as occasional consumers, 18% (from 6% (PT, RU) to 27% (DE)) as light consumers, and 13% (from 1% (RU) and 5% (IL, NO) to 26% (BG)) as heavy consumers. Thus, distribution varies considerably across countries (Annex 7, Figure A 7.5).

The relationship of the frequency of alcohol consumption and General HL is rather curvilinear, e.g., higher percentages of those who never consume alcohol are found in both the lowest and the highest HL groups (Figure 7.4). The association for individual countries differs widely (Annex 7, Figure A 7.6).

Figure 7.4:
Percentage distribution of four categories of alcohol consumption by GEN-HL (10 groups from lowest HL to highest HL), for all countries (equally weighted)



Source: HLS19 Consortium

The correlation with General HL is, on average, with ρ=−0.05, the second lowest of all correlations and varies inconsistently, i.e., for some countries negatively from ρ=−0.01 (HU) to ρ=−0.13 (IL) and for others positively from ρ=0 (CH, PT) to ρ=+0.05 (BE, DK). Thus, the intensity of alcohol consumption is much weaker related to General HL than with socio-demographic and socio-economic indicators (Annex 7, Table A 7.6).

The regression model explains on average 8% of the variation in alcohol consumption (varying from 5% (IE, NO) to 16% (PT)). General HL is on average the predictor with the second lowest β=−0.05 and varies inconsistently, for some countries with a negative β ranging from −0.01 (IE, SK) to −0.13 (IL) and for a few with a positive β ranging from 0 (FR) to 0.09 (PT) (Table 7.3). For the same model with unstandardized coefficients (b), see Annex 7, Table A 7.7.

Thus, just a small significant effect of General HL on alcohol consumption was demonstrated for the average of countries, with expected significant effects for four countries and one unexpected significant effect for one country.

Table 7.3:
Multivariable linear regression models of alcohol consumption by GEN-HL and five core social determinants (standardized coefficients (β) and R^2), for each country and for all countries (equally weighted)

	AT	BE	BG	CH	CZ	DE	DK	FR	HU	IE	IL	IT	NO	PT	RU	SI	SK	All
GEN-HL	**−0.05**	0.02	−0.02	0.01	−0.06	**−0.06**	−0.02	0	−0.03	−0.01	**−0.13**	0.01	−0.03	**0.09**	**−0.07**	−0.03	−0.01	**−0.05**
Gender female	**−0.25**	**−0.15**	**−0.2**	**−0.21**	**−0.33**	**−0.24**	**−0.1**	**−0.18**	**−0.35**	**−0.09**	**−0.16**	**−0.25**	**−0.13**	**−0.35**	**−0.24**	**−0.31**	**−0.3**	**−0.22**
Age in years	**0.08**	**0.16**	**0.15**	**0.21**	**−0.1**	0.03	**0.25**	**0.19**	0.03	**0.06**	0	0.03	**0.09**	**0.13**	**−0.12**	0	−0.03	**0.1**
Education	**0.08**	**0.14**	**0.12**	**0.12**	**0.09**	0.05	**0.1**	0.05	0.04	**0.19**	**0.12**	**0.07**	**0.13**	−0.04	**0.04**	**0.08**	**0.07**	**0.1**
Level in society	0.05	**0.13**	0.03	0	0	0.04	**0.11**	0.06	−0.03	−0.01	−0.03	0	**0.06**	0.03	**−0.05**	0.01	0.04	**0.03**
Financial deprivation	**−0.05**	−0.03	−0.07	**−0.1**	−0.06	−0.02	−0.04	−0.03	−0.08	**−0.06**	−0.06	−0.04	−0.03	0.03	−0.01	−0.02	−0.01	**−0.07**
R^2	0.09	0.09	0.12	0.13	0.13	0.07	0.15	0.08	0.14	0.05	0.06	0.07	0.05	0.16	0.08	0.1	0.1	0.08
Valid count	2690	988	705	2019	1565	1818	3544	2003	1123	4301	1155	3239	2673	1168	5084	3169	1789	
Total count	2967	1000	865	2502	1599	2143	3602	2003	1195	4487	1315	3500	2855	1247	5660	3360	2145	

Coefficients with p-values lower than 0.01 in bold.
Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of −0.005 to +0.005.
Alcohol consumption: from (1) never to (4) heavy.
GEN-HL score: from 0=minimal HL to 100=maximal HL.
Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

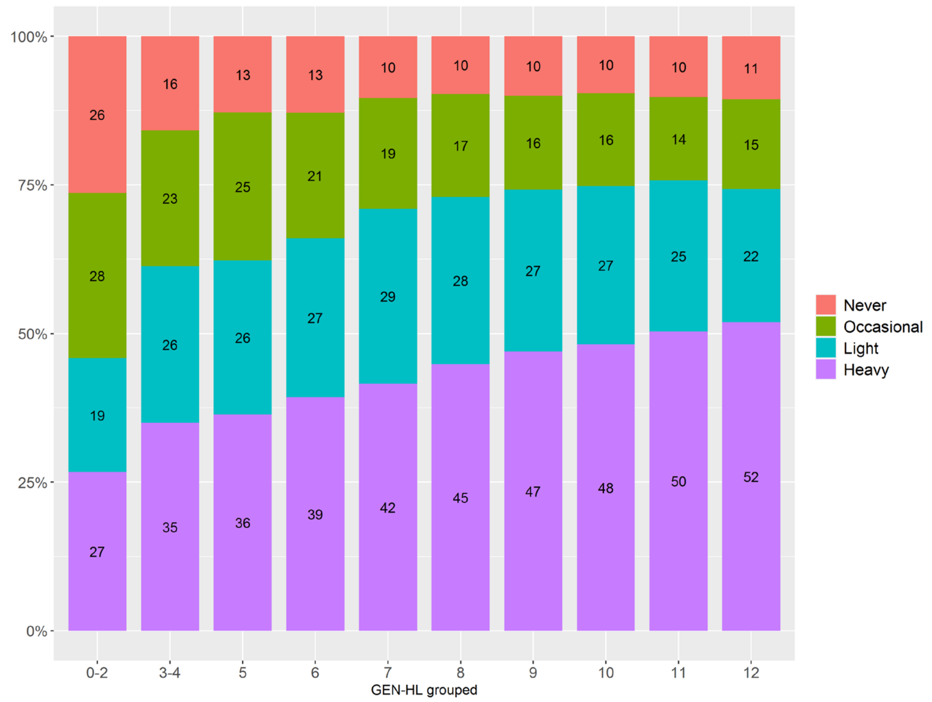
Source: HLS_{19} Consortium

7.6 General HL and physical activity

On average 11% (from 2% (DK) to 28% (CZ)) of respondents were categorized as never performing physical activity, 17% (from 5% (IE) to 28% (PT)) as occasional performers, 26% (from 21% (HU, IE, and PT) to 32% (DE)) as light performers, and 46% (from 22% (CZ) to 71% (IE)) as heavy performers. Thus, there is considerable variation across countries in relation to the extent of physical activity (Annex 7, Figure A 7.7).

On average, a positive, rather linear relationship can be observed for the extent of physical activity and General HL. Respondents with higher General HL have a higher intensity of physical activity (Figure 7.5). This was found in most countries, with just a few deviations (Annex 7, Figure A 7.8).

Figure 7.5:
Percentage distribution of four categories of physical activity by GEN-HL (10 groups from lowest HL to highest HL), for all countries (equally weighted)



Source: HLS19 Consortium

Compared to the other lifestyle indicators, there is, on average, a somewhat higher association of physical activity with General HL, with ρ=0.11, varying from 0.04 (FR, HU) to 0.2 (SK). This association is therefore the highest one, compared to the correlations with the socio-demographic, socio-economic, and other indicators (Annex 7, Table A 7.8).

The regression model explains on average just 3% of the variance (varying from 1% (IE) to 9% (SK)). However, in this case, General HL is by far the predictor with the highest ß (on average β=0.11, varying from 0.03 (FR) to 0.27 (BG)) (Table 7.4). (For the same model with unstandardized coefficients (b), see Annex 7, Table A 7.9).

Thus, General HL was revealed to be a significant and relevant predictor of the extent of physical activity for most countries, with very few exceptions.

Table 7.4:
Multivariable linear regression models of physical activity by GEN-HL and five core social determinants (standardized coefficients (β) and R^2), for each country and for all countries (equally weighted)

	AT	BE	BG	CH	CZ	DE	DK	FR	HU	IE	IL	IT	NO	PT	RU	SI	SK	All
GEN-HL	**0.1**	**0.11**	**0.27**	0.04	**0.09**	**0.09**	**0.1**	0.03	0.08	**0.08**	0.04	**0.12**	**0.09**	0.07	**0.14**	**0.18**	**0.19**	**0.11**
Gender female	0.03	-0.03	-0.04	-0.05	-0.03	**-0.07**	0.04	-0.01	**-0.1**	-0.04	-0.01	-0.04	**0.06**	-0.03	**-0.07**	**-0.05**	**-0.1**	**-0.03**
Age in years	**-0.12**	0	0.01	0.04	**-0.13**	**-0.09**	0.02	**0.06**	-0.07	0.03	0.04	-0.03	0.01	**-0.11**	**-0.11**	**-0.05**	**-0.07**	**-0.02**
Education	0.04	0.03	0.05	0	0.03	0.06	0.03	**0.09**	0.02	**0.05**	-0.01	**0.06**	0.01	0.08	0	0.02	0.04	**0.06**
Level in society	0	0.07	-0.09	0.01	0.07	0	0	0.05	0.02	**0.06**	**0.13**	0.04	0.02	**0.12**	**0.06**	0.05	**0.11**	**0.05**
Financial deprivation	-0.03	-0.04	0.09	**-0.1**	-0.03	-0.05	**-0.05**	-0.05	0.04	0.02	**-0.1**	-0.05	-0.04	0	-0.03	0.05	0.02	**-0.05**
R^2	0.03	0.02	0.07	0.02	0.04	0.03	0.02	0.02	0.02	0.01	0.04	0.04	0.02	0.07	0.06	0.04	0.09	0.03
Valid count	2685	988	698	2018	1566	1813	3543	2003	1122	4301	1155	3237	2673	1168	4873	3170	1784	
Total count	2967	1000	865	2502	1599	2143	3602	2003	1195	4487	1315	3500	2855	1247	5660	3360	2145	

Coefficients with p-values lower than 0.01 in bold.
Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of -0.005 to +0.005.
Physical activity: from (1) never to (4) heavy.
GEN-HL score: from 0=minimal HL to 100=maximal HL.
Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

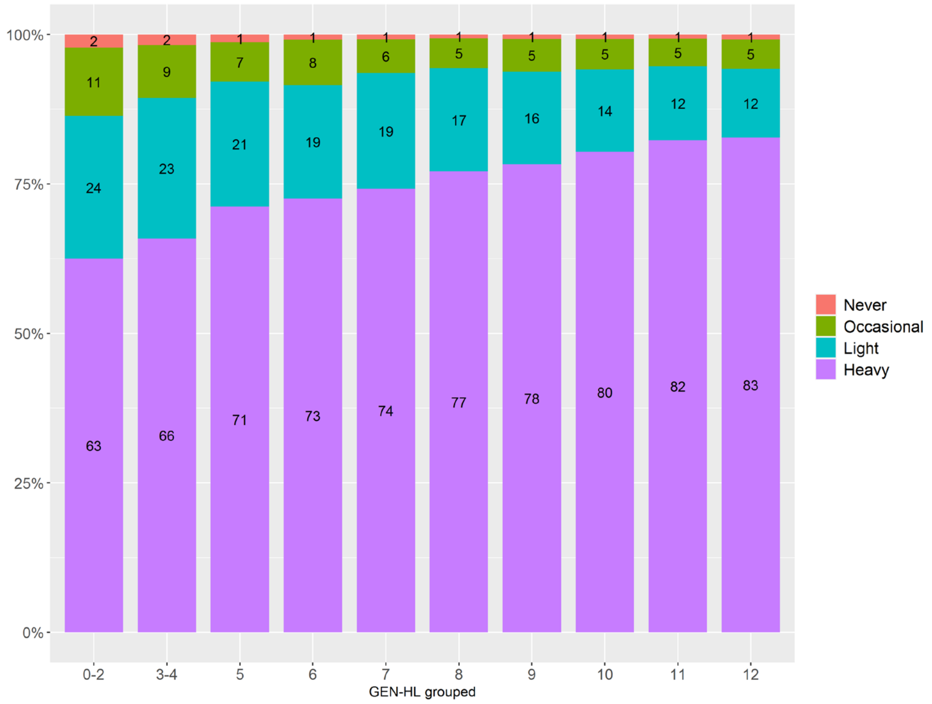
Source: HLS_{19} Consortium

7.7 General HL and fruit and vegetable consumption

On average just 1% (from 0% (AT, BG, DE, NO, and PT) to 2% (FR, IL, and IT)) of respondents were classified as never consuming fruit and vegetables, 6% (from 2% (IE; NO) to 11% (CZ, IL)) as occasional consumers, 15% (from 8% (PT) to 24% (CZ)) as light consumers, and 78% (from 65% (CZ) to 88% (NO)) as heavy consumers. This distribution varies moderately across countries (Annex 7, Figure A 7.9).

A positive, rather linear relationship between the frequency of fruit and vegetable consumption and General HL was found on average. Respondents with higher HL consume more fruit and vegetables (Figure 7.6). This trend was found im most of the participating countries, but with a few irregularities for some countries (Annex 7, Figure A 7.10).

Figure 7.6:
Percentage distribution of four categories of fruit and vegetable consumption by GEN-HL (10 groups from lowest HL to highest HL), for all countries (equally weighted)



Source: HLS19 Consortium

General HL on average is relatively highly associated with fruit and vegetable consumption, with a mean ρ of 0.11, varying from 0.05 (IE) to 0.17 (RU, SK), except for ρ=-0.02 (PT). Fruit and vegetable consumption is as highly correlated with General HL as with gender female (ρ=0.11), level in society (ρ=0.11), and financial deprivation (ρ=-0.11) (Annex 7, Table A 7.10).

This multivariable linear regression model only explains 4% of the variance in fruit and vegetable consumption (varying from 4% (HU, IE, PT, and SI) to 9% (SK)). However, General HL is, on average, with a value of β=0.09 (varying from −0.01 (PT) to 0.18 (SK)), the predictor with the second highest ß in the model, after gender female (β=0.11) (Table 7.5). (For the same model with unstandardized coefficients (b), see Annex 7, Table A 7.12).

Thus, General HL was revealed to be a relevant and significant predictor of fruit and vegetable consumption for most countries, with a few exceptions.

Table 7.5:
Multivariable linear regression models of fruit and vegetable consumption by GEN-HL and five core social determinants (standardized coefficients (β) and R^2), for each country and for all countries (equally weighted)

	AT	BE	BG	CH	CZ	DE	DK	FR	HU	IE	IL	IT	NO	PT	RU	SI	SK	All
GEN-HL	**0.12**	0.07	**0.12**	0.03	0.01	**0.07**	**0.07**	0.04	0.04	0.03	0.06	**0.13**	0.05	−0.01	**0.12**	**0.1**	**0.18**	**0.09**
Gender female	**0.14**	**0.16**	0.06	**0.13**	**0.17**	**0.19**	**0.17**	**0.11**	**0.1**	**0.14**	0.03	**0.06**	**0.17**	**0.14**	**0.06**	**0.09**	**0.12**	**0.11**
Age in years	**−0.07**	**0.09**	0.06	**0.11**	**0.1**	0.05	0	**0.16**	**0.12**	−0.04	**0.16**	**0.16**	0.02	**0.15**	**0.05**	**0.11**	0.05	**0.08**
Education	0.04	**0.12**	**0.1**	**0.09**	0.06	**0.07**	**0.14**	**0.15**	0.07	**0.11**	0	**0.06**	**0.11**	0.01	**0.12**	0.02	**0.07**	**0.06**
Level in society	0	**0.14**	0.1	**0.07**	**0.09**	0.05	**0.06**	0.05	0.05	0.04	**0.09**	−0.03	0.04	0.04	**0.08**	**0.11**	**0.1**	**0.06**
Financial deprivation	−0.05	−0.05	0.07	**−0.12**	−0.07	−0.06	**−0.06**	**−0.08**	−0.08	−0.03	−0.06	−0.05	**−0.06**	−0.04	**−0.11**	0.01	−0.02	**−0.06**
R^2	0.05	0.08	0.05	0.07	0.05	0.06	0.08	0.07	0.04	0.04	0.06	0.05	0.06	0.04	0.07	0.04	0.09	0.04
Valid count	2692	988	716	2020	1568	1831	3555	2003	1123	4301	1156	3232	2679	1168	4884	3169	1790	
Total count	2967	1000	865	2502	1599	2143	3602	2003	1195	4487	1315	3500	2855	1247	5660	3360	2145	

Coefficients with p-values lower than 0.01 in bold.
Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of −0.005 to +0.005.
Fruit and vegetable consumption: from (1) never to (4) heavy.
GEN-HL score: from 0=minimal HL to 100=maximal HL.
Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

Source: HLS_{19} Consortium

7.8 Discussion and conclusions

Of the five potential health behavior and lifestyle indicators examined, two showed relevant and significant correlations and regression coefficients with General HL on average and for a majority of the participating countries: physical activity (ρ=0.11, varying from 0.04 (FR, HU) to 0.20 (SK); on average β=0.11, varying from 0.03 (FR) to 0.27 (BG)) and fruit and vegetable consumption (ρ=0.11, varying from 0.05 (IE) to 0.17 (RU, SK); on average β=0.09, varying from -0.01 (PT) to 0.18 (SK)).

For the other three indicators there is no or only a small relevant significant effect for General HL. For BMI, on average, a significant effect is only demonstrated for very few countries. There is no consistent and relevant effect of General HL on smoking behavior and alcohol consumption for the countries on average, but opposite significant effects were found for a few countries. These results are, in principle, consistent with the results highlighted from a few earlier studies (cf. Section 7.1).

Thus, the research questions could be answered positively only to a different and partly limited degree by the HLS_{19} results, as in earlier studies, but the results confirmed that HL is a relevant determinant of more physical activity and more fruit and vegetable consumption for all countries as well as of better BMI and less alcohol consumption for some countries. It therefore matters for health policy.

Limitations: Due to only cross-sectional data being available, the causal assumptions underlying the specified models could not be tested empirically. Due to the limited standardization of the HLS_{19} study design (mainly the type and time of data collection), alongside the range in variation across countries, comparisons of the results between individual countries have not been described or interpreted in the International Report and must be interpreted with caution when undertaken selectively by countries themselves. Comparison with the results of the HLS-EU is further limited by changes in the measure of General HL, by changes in all measures of health behaviors and lifestyle indicators as well as in one of the core determinants, by changes in the method of data collection, and by mostly different countries included in the two studies. In comparison with the HLS-EU, just four indicators were measured and measured differently for health behaviors and lifestyles which can be compared in principle: physical activity (with the strongest significant bivariate association also in a multivariable linear regression model); body-mass index (BMI); alcohol consumption (with significant slight associations); and smoking behavior (with no or inconsistent associations). Thus, the HLS_{19} to a certain degree confirms the results of the HLS-EU.

Comparison with other published results, as highlighted in the background section, is even more difficult due to more differences in the methodology used, but the results found in earlier studies were also partly confirmed by the HLS_{19} results.

In conclusion, as far as this is possible with data from a cross-sectional study design, the HLS_{19} enriched the evidence for more countries in the WHO European Region that General HL is relevant for some health behaviors and lifestyles indicators and, therefore, also relevant for health policy and practice in the WHO European Region.

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8 General Health Literacy as a predictor of health status

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8.1 Background

Previous research

The association of HL with different indicators of health status has been researched and presented in international publications, especially in relation to certain indicators, as well as in the HLS-EU and its follow up studies, so relevant research questions were included in the HLS_{19} as well. Previous empirical research suggests that the main role of HL is in explaining variance in perceived health status. Evidence from two systematic reviews supports the independent contribution of HL to perceived health status and suggests a possible mediating role for HL (Berkman et al. 2011; Mantwill et al. 2015). Besides it being a determinant, a limited contribution of HL as a moderator or mediator of self-perceived health status was also demonstrated using the original HLS-EU data (Pelikan et al. 2018). A recent review highlighted a mediating function in the relationship between socio-economic factors and health outcomes, health-related behaviors, quality of life, and self-rated health status (Stormacq et al. 2019).

In the HLS-EU study, three indicators were taken from the Minimum European Health Module (MEHM) to measure an individual's health status, all of which showed significant correlations with HL: self-perceived health (ρ=-.27 on average, varying by country from ρ=-.15 to ρ=-.33), number of long-term illnesses or health problems (ρ=.16 on average, varying from ρ=.05 to ρ=.26), and the intensity of disease-related limitations (ρ=.17 on average, from ρ=.08 to ρ=.32). In a multivariable linear regression model with five socio-demographic and socio-economic core determinants, the NVS for functional HL, and the HLS-EU-Q47 for comprehensive HL as independent variables of self-perceived health which, on average, explained 27% of the variance (from 9% to 45%), the comprehensive HLS-EU-Q47 was the second highest predictor of self-perceived health (β=.17 on average, varying from β=.09 to β=.21) after age (β=-.37) (HLS-EU Consortium 2012; Pelikan/Ganahl 2017b; Sørensen et al. 2015).

In a cross-sectional survey in Israel using an instrument based on the HLS-EU-Q16, Levin-Zamir et al. (2016) found that HL and age were the highest predictors of perceived health status among adults. A recent nationwide study in Denmark showed that individuals with lower HL, as measured by the HLS-EU-Q16, reported poorer health status and more compensation benefits for being on sick leave as a proxy measure of health status (Svendsen et al. 2020).

Therefore, in the HLS-EU conceptual model of HL (Sørensen et al. 2012) and the refined Vienna Model of Health Literacy (see Figure 1.2, Chapter 1) (Pelikan/Ganahl 2017a), also used in the HLS_{19}, it was hypothesized that HL will have direct and indirect effects on indicators of personal health status. Thus, in the HLS_{19} the research question 'Is there a relevant and significant effect of General HL on health status?' was investigated but not how the variance in indicators of health status can best be explained. However, in a cross-sectional study like the HLS_{19}, the research question can only be answered in a limited, explorative way because the underlying causal assumptions cannot be tested empirically with the existing set of data.

Health status variables in the HLS_{19} in comparison with the HLS-EU

To measure health status, the three items used in the HLS-EU were taken, but in the response category of self-perceived health, an explanation for the wording “fair” (i.e., neither good nor bad) was added. The precise wording of the items and response categories used as well as the source of the original items are provided in Annex 8, Table A 8.1.

Summing up, the variables used in the HLS_{19} to explore health status and their categories are:

» self-perceived health, represented by five categories: very good-good-fair-bad-very bad,
» long-term illnesses/health problems, represented by three categories (none, one, more than one long-term illness/health problem), except for one country (SI), where two categories were used (none and one or more long-term illnesses/health problems).
» limitations due to health problems, represented by three categories: not limited, limited but not severely, severely limited.

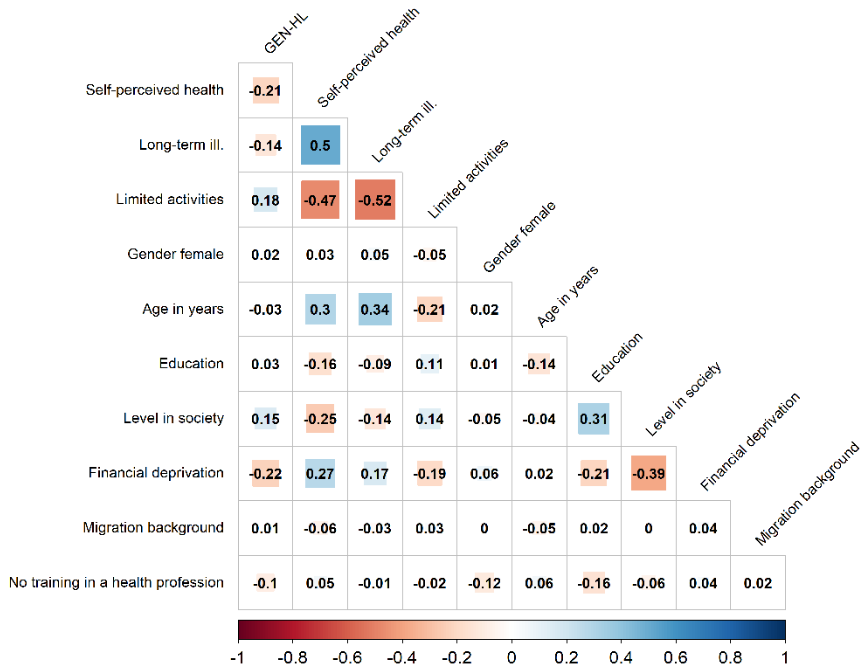
Data analyses and results in this chapter are presented by:

» percentage distributions of health status indicators (Annex 8),
» associations of health status indicators with General HL (for all countries in the main chapter and for individual countries in Annex 8),
» Spearman correlations (ρ) among indicators of health status, with General HL and selected socio-demographic and socio-economic determinants (for all countries in the main chapter and for individual countries in Annex 8),
» regression analyses: adjusted R^2 and standardized β coefficients of multivariable linear regression models are used to compare the relative importance of the predictors included (results in the main chapter). Annex 8 provides the results of regression models with unstandardized coefficients (b).

8.2 Spearman correlations among indicators of health status with General HL and selected socio-demographic and socio-economic determinants

On average, the three health status indicators are highly correlated with $\rho=0.5$ for “self-perceived health” and “long-term illnesses/health problems”, $\rho=-0.47$ for “self-perceived health” and “limitations due to health problems”, and $\rho=-0.52$ for “long-term illnesses/health problems” and “limitations due to health problems”. General HL correlates with “self-perceived health” ($\rho=-0.21$), “long-term illnesses/health problems” ($\rho=-0.14$), and “limitations due to health problems” ($\rho=0.18$) (Figure 8.1).

Figure 8.1:
Spearman correlations (ρ) among indicators of health status, with GEN-HL, and selected socio-demographic and socio-economic determinants, for all countries (equally weighted)*



* Values for the correlations with migration should be treated with caution as in five countries (BG, HU, IT, RU, and SK), the percentage of respondents with a migration background was below 10%, and the HLS_{19} survey as such was not adjusted to targeting migrants specifically (e.g., by offering translations of the instrument into migrant languages).

Source: HLS_{19} Consortium

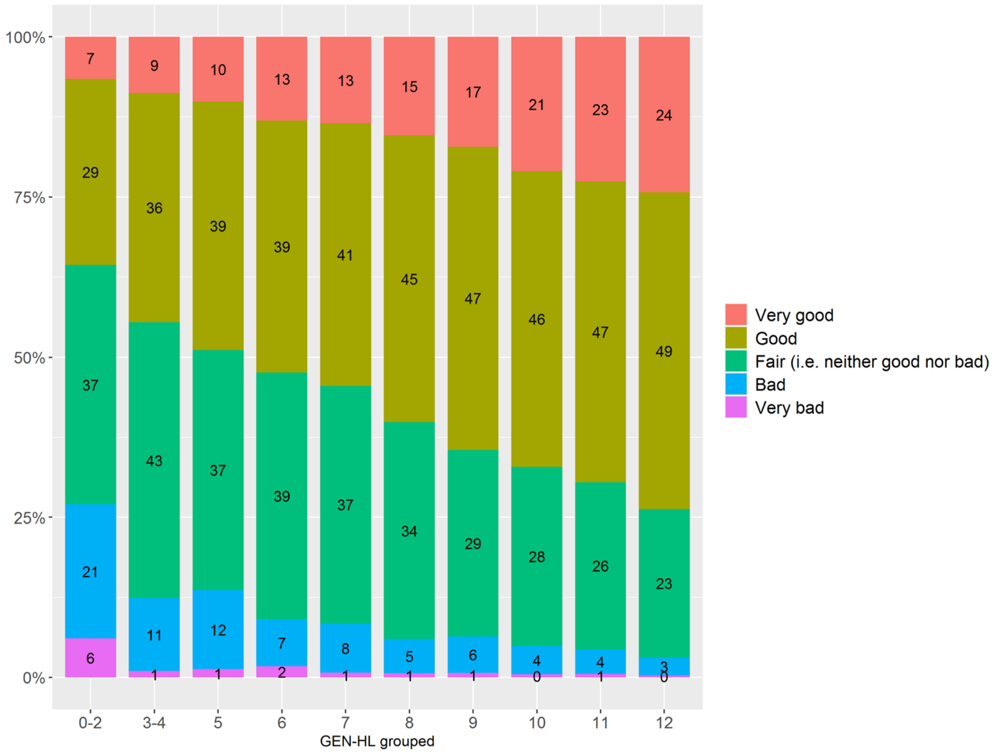
On average, there are also relatively high correlations of the three indicators with socio-demographic and socio-economic indicators, especially with “age” and “financial deprivation”, and somewhat lower also with “level in society” and “education” (Figure 8.1).

8.3 General HL and self-perceived health

On average in the participating countries, 19% of the respondents reported their self-perceived health as “very good” (from 4% (RU) to 37% (AT)), 45% as “good” (from 37% (RU) to 54% (CH)), 30% as “fair” (from 15% (AT, NO) to 53% (RU)), 6% as “bad “ (from 2% (AT) to 9% (CZ)), and just 1% as “very bad” (from 0% (AT, CH, IL, and PT) to 2% (CZ, HU)). Thus, there is considerable variation in self-perceived health status across the participating countries (Annex 8, Figure A 8.1).

The relationship between self-perceived health and General HL is linear, on average. Better HL is associated with better self-perceived health (Figure 8.2). This relationship can also be observed in most countries although it varies somewhat by degree and by level of self-perceived health (Annex 8, Figure A 8.2).

Figure 8.2:
Percentage distribution of five categories of self-perceived health by GEN-HL (10 groups from lowest HL to highest HL), for all countries (equally weighted)



Source: HLS_{19} Consortium

There is a correlation between self-perceived health and General HL (ρ=-0.21, varying from -0.07 (CZ) to -0.38 (BG)). There are also correlations between self-perceived health and four of the five socio-demographic and socio-economic determinants of General HL, namely age (ρ=0.3), financial deprivation (ρ=0.27), level in society (ρ=-0.25), education (ρ=-0.16), and female gender (ρ=0.03). For migration (ρ=-0.06) and training in a health profession (ρ=0.05), the correlation is very low (Annex 8, Table A 8.2).

To answer the research question as to whether a specific direct effect of General HL on self-perceived health can be demonstrated, when other determinants correlating with self-perceived health and General HL are controlled for, a multivariable linear regression model was used.

On average, this multivariable linear regression model (Table 8.1; for the model with unstandardized coefficients (b), see Annex 8, Table A 8.3) explains 21% of the variance (varying from 11% (IE) to 38% (BG)). The predictor with the highest β is age (β=0.26, varying from β=0.08 (BE) to β=0.42 (SK)). The predictor with the second highest ß is financial deprivation (β=0.16, varying from −0.03 (BE) to 0.22 (HU)). General HL (β=−0.15, varying from β=−0.07 (SK) to β=−0.22 (DK)) and level in society (β=−0.15, varying from −0.06 (RU) to −0.27 (BE)) are the predictors with the third highest β. Education has a much lower β (β=−0.05, varying from 0.01 (IL) to −0.19 (BG)). With β=0.01 on average gender has no predictive value (varying inconsistently, partly positively and partly negatively across countries).

Thus, it has been demonstrated that General HL is a relevant and significant predictor of self-perceived health in the participating countries, albeit varying in strength across these countries.

Table 8.1:
Multivariable linear regression models of self-perceived health by GEN-HL and five core social determinants (standardized coefficients (β) and R^2), for each country and for all countries (equally weighted)

	AT	BE	BG	CH	CZ	DE	DK	FR	HU	IE	IL	IT	NO	PT	RU	SI	SK	All
GEN-HL	**−0.18**	**−0.14**	**−0.2**	**−0.15**	**−0.08**	**−0.14**	**−0.22**	**−0.16**	**−0.12**	**−0.11**	**−0.13**	**−0.12**	**−0.14**	**−0.12**	**−0.14**	**−0.15**	**−0.07**	−0.15
Gender female	−0.01	0.05	0.01	−0.04	−0.03	−0.02	**−0.05**	−0.01	0.04	−0.02	−0.01	0	0.02	**0.09**	0.02	0.02	0.01	0.01
Age in years	**0.23**	0.08	**0.26**	**0.22**	**0.35**	**0.41**	**0.11**	**0.24**	**0.31**	**0.11**	**0.31**	**0.24**	**0.18**	**0.35**	**0.36**	**0.36**	**0.42**	0.26
Education	**−0.06**	**−0.08**	**−0.19**	−0.03	**−0.11**	−0.03	−0.03	0.02	−0.05	**−0.1**	0.01	0.02	**−0.09**	**−0.11**	**−0.05**	**−0.07**	−0.05	−0.05
Level in society	**−0.11**	**−0.27**	**−0.11**	**−0.18**	**−0.13**	**−0.09**	**−0.14**	**−0.22**	**−0.12**	**−0.11**	**−0.16**	**−0.14**	**−0.17**	**−0.09**	**−0.06**	**−0.08**	**−0.11**	−0.15
Financial deprivation	**0.14**	−0.03	**0.13**	**0.15**	**0.16**	**0.13**	**0.17**	**0.1**	**0.22**	**0.16**	**0.12**	**0.16**	**0.15**	**0.16**	**0.17**	**0.18**	**0.16**	0.16
R^2	0.16	0.13	0.38	0.16	0.24	0.26	0.16	0.17	0.27	0.11	0.17	0.14	0.13	0.35	0.29	0.31	0.33	0.21
Valid count	2691	988	721	2019	1567	1845	3561	2003	1124	4301	1154	3240	2681	1168	5079	3184	1794	
Total count	2967	1000	865	2502	1599	2143	3602	2003	1195	4487	1315	3500	2855	1247	5660	3360	2145	

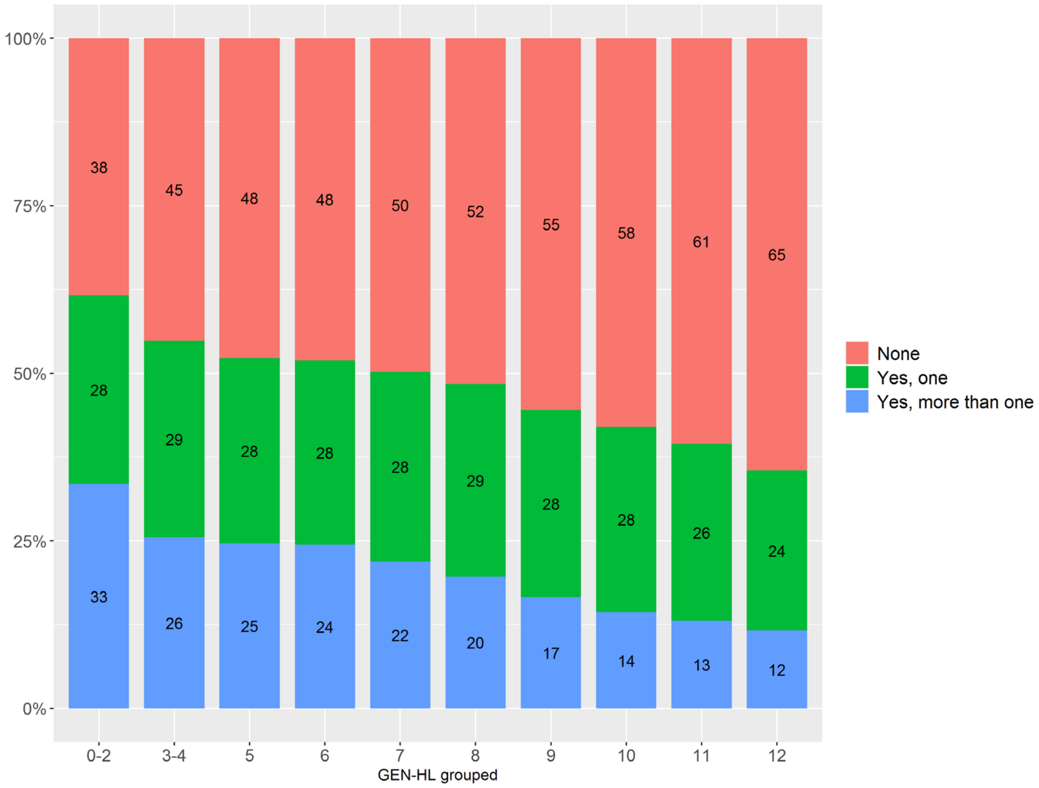
Coefficients with p-values lower than 0.01 in bold.
Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of −0.005 to +0.005.
Self-perceived health: from very good (1) to very bad (5).
GEN-HL score: from 0=minimal HL to 100=maximal HL.
Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

Source: HLS_{19} Consortium

8.4 General HL and long-term illnesses/health problems

On average, 55% of the respondents (from 40% (CZ) to 65% (PT)) had none, 28% (from 16% (DE) to 36% (FR)) had one, and 18% (from 7% (AT) to 36% (DE)) had more than one long-term illness/health problem. The percentage distribution varies considerably by country (Annex 8, Figure A 8.3). There is a negative, rather linear relationship between long-term illnesses/health problems and General HL on average. Respondents with higher HL have fewer long-term illnesses/health problems (Figure 8.3). This relationship also holds true also for individual countries with few exceptions (Annex 8, Figure A 8.4).

Figure 8.3:
Percentage distribution of three categories of long-term illnesses/health problems by GEN-HL (10 groups from lowest HL to highest HL), for all countries (equally weighted)*



* SI was not included in Figure 8.3 as a slightly different measure was used with only two categories for long-term illnesses/health problems: (1) no and (2) one or more long-term illnesses/health problems.

Source: HLS19 Consortium

The average correlation between long-term illnesses/health problems and General HL is ρ=−0.14, varying from −0.03 (BE, CZ) to −0.28 (RU). This means that General HL is the predictor with the third highest ρ in the model (ρ=−0.14), along with level in society. Age (ρ=0.34) has the highest and financial deprivation the second highest correlation (ρ=0.17) with long-term illnesses/health problems (Annex 8, Table A 8.4).

This multivariable linear regression model (Table 8.2; for the model with unstandardized coefficients (b), see Annex 8, Table A 8.5) explains 15% of the variance on average for the number of long-term illnesses (varying from 8% (IT, NO) to 37% (BG)). It explains somewhat less variation than self-perceived health with 21%. With a β of −0.09 (varying from −0.02 (BE) to −0.19 (PT)), General HL is, on average, the predictor with the third highest β in the model, after age (β=0.31) and financial deprivation (β=0.11).

Thus, it has been demonstrated that General HL is a relevant and significant predictor of long-term illnesses/health problems in some of the participating countries, albeit varying considerably in strength across these countries.

Table 8.2:

Multivariable linear regression models of long-term illnesses/health problems by GEN-HL and five core social determinants (standardized coefficients (β) and R^2), for each country and for all countries (equally weighted)

	AT	BE	BG	CH	CZ	DE	DK	FR	HU	IE	IL	IT	NO	PT	RU	SI	SK	All
GEN-HL	**−0.07**	−0.02	−0.07	**−0.06**	−0.05	−0.03	**−0.06**	**−0.06**	−0.05	−0.04	−0.05	−0.04	−0.04	**−0.19**	**−0.13**	**−0.07**	−0.04	**−0.09**
Gender female	0.02	**0.09**	−0.03	−0.01	0.04	0.03	−0.01	−0.01	**0.07**	**0.08**	0.02	−0.02	**0.07**	**0.07**	**0.07**	**0.05**	0.04	**0.04**
Age in years	**0.24**	**0.2**	**0.47**	**0.27**	**0.31**	**0.44**	**0.19**	**0.28**	**0.37**	**0.25**	**0.36**	**0.26**	**0.2**	**0.31**	**0.39**	**0.3**	**0.45**	**0.31**
Education	**−0.07**	**−0.09**	**−0.15**	−0.01	−0.05	0.03	−0.01	0.02	0.01	**−0.07**	−0.03	**0.07**	**−0.07**	0.02	0.03	−0.04	−0.01	−0.01
Level in society	**−0.09**	**−0.15**	**−0.12**	**−0.08**	−0.05	**−0.09**	**−0.07**	−0.02	−0.05	**−0.09**	**−0.09**	−0.03	**−0.07**	−0.02	**−0.09**	−0.01	−0.01	**−0.07**
Financial deprivation	**0.13**	**0.09**	0	0.06	**0.12**	**0.08**	**0.15**	**0.13**	**0.2**	**0.1**	**0.1**	**0.11**	**0.15**	**0.15**	**0.13**	**0.11**	**0.12**	**0.11**
R^2	0.13	0.1	0.37	0.09	0.13	0.23	0.09	0.1	0.25	0.12	0.16	0.08	0.08	0.23	0.28	0.15	0.27	0.15
Valid count	2686	988	705	2017	1568	1821	3557	2003	1121	4291	1155	3185	2663	1163	4910	3183	1774	
Total count	2967	1000	865	2502	1599	2143	3602	2003	1195	4487	1315	3500	2855	1247	5660	3360	2145	

Coefficients with p-values lower than 0.01 in bold.

Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of −0.005 to +0.005.

Long-term illness: 3 categories: (1) none, (2) one, (3) more than one, except for SI where 2 categories were used (1) none, (2) one or more.

GEN-HL score: from 0=minimal HL to 100=maximal HL.

Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).

Level in society from 1=lowest level to 10=highest level in society.

Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

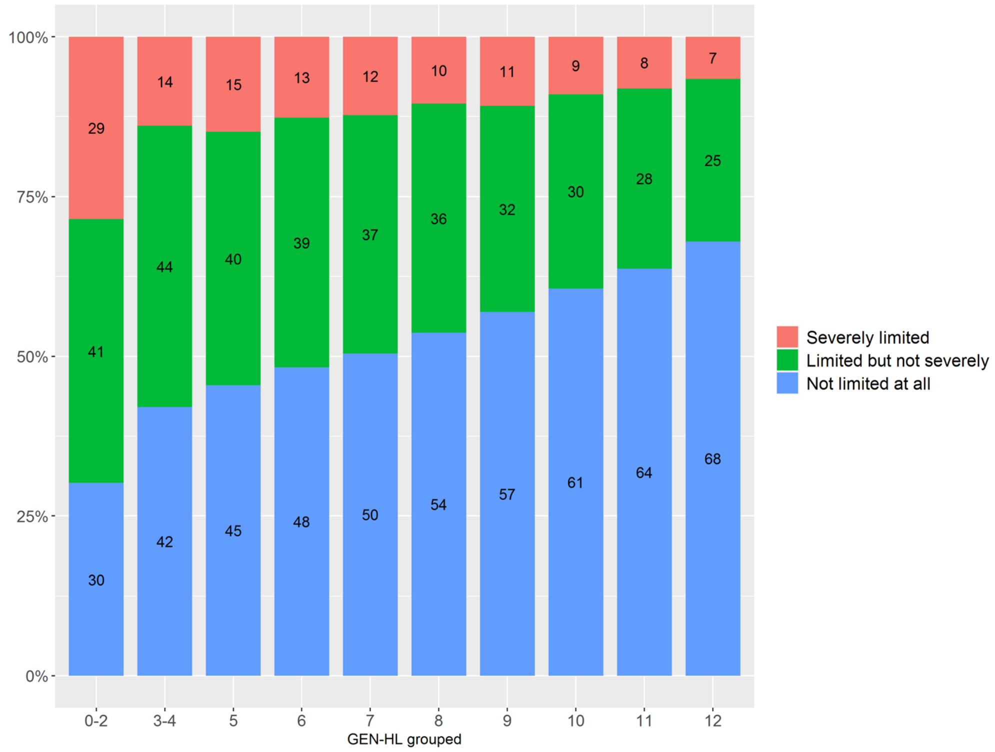
Source: HLS_{19} Consortium

8.5 General HL and limitations due to health problems

The percentage distribution of the intensity of limitations due to health problems is, on average, rather J-shaped with 10% (varying from 5% (HU, PT) to 20% (BE)) "severely limited", 32% (from 19% (FR) to 55% (BE)) "limited but not severely", and 58% (from 25% (BE) to 75% (HU)) "not limited at all", and there is considerable variation by country (Annex 8, Figure A 8.5).

The relationship of the intensity of limitations due to health problems with General HL is positive and rather linear on average: the higher the General HL, the higher the percentage of respondents who are not limited at all by long-term illnesses/health problems (Figure 8.4). For individual countries this also holds true, but with some irregularities for some countries (Annex 8, Figure A 8.6).

Figure 8.4:
Percentage distribution of three categories of limitations due to health problems by GEN-HL (10 groups from lowest HL to highest HL), for all countries (equally weighted)



Source: HLS19 Consortium

The correlation with General HL is, on average, ρ=0.18 (varying from 0.06 (IL) to 0.3 (PT)). Thus, General HL is the predictor with the third highest ρ, after age (ρ=-0.21) and financial deprivation (ρ=-0.19). Level in society (ρ=0.14) is the predictor with the fourth highest ρ, followed by education (ρ=0.11) (Annex 8, Table A 8.6).

The multivariable linear regression model (Table 8.3) explains, on average, 10% of the variance of limitations due to health problems (varying from 3% (IL) to 22% (PT)). It explains somewhat less of the variance than self-perceived health (21%) or long-term illnesses/health problems (15%). On average, General HL (β=0.14, varying from 0 (IL) to 0.21 (PT)) the predictor with the second highest β, after age (β=−0.18). Financial deprivation (β=−0.13) is the predictor with the third highest β.

Thus, it has been demonstrated that General HL is a relevant and significant predictor of limitations due to health problems in most countries, albeit varying in strength across these countries.

Table 8.3:
Multivariable linear regression models of limitations due to health problems by GEN-HL and five core social determinants (standardized coefficients (β) and R^2), for each country and for all countries (equally weighted)

	AT	BE	BG	CH	CZ	DE	DK	FR	HU	IE	IL	IT	NO	PT	RU	SI	SK	All
GEN-HL	**0.11**	0.06	**0.17**	**0.14**	0.06	**0.09**	**0.09**	0.05	**0.11**	**0.07**	0	**0.11**	**0.06**	**0.21**	**0.11**	**0.15**	**0.10**	**0.14**
Gender female	0	**−0.13**	−0.02	−0.04	−0.03	−0.04	0	0.03	−0.07	−0.04	−0.02	−0.02	**−0.12**	**−0.11**	−0.01	**−0.05**	0	**−0.04**
Age in years	**−0.13**	0.02	**−0.19**	**−0.15**	**−0.2**	**−0.34**	**−0.14**	**−0.11**	**−0.27**	0.04	−0.03	**−0.12**	**−0.12**	**−0.17**	**−0.28**	**−0.25**	**−0.31**	**−0.18**
Education	**0.09**	**0.13**	**0.16**	−0.02	**0.1**	0	0.02	−0.02	0.03	**0.17**	**0.11**	0.04	**0.11**	0.04	**0.05**	0.05	0.05	**0.04**
Level in society	**0.13**	**0.15**	**0.15**	**0.14**	0.04	**0.07**	**0.11**	0.02	0.03	**0.09**	−0.03	0.02	**0.1**	0.05	**0.07**	**0.06**	0.02	**0.05**
Financial deprivation	**−0.15**	0.10	0.01	**−0.1**	**−0.14**	**−0.13**	**−0.17**	**−0.15**	**−0.19**	**−0.17**	**−0.11**	**−0.15**	**−0.14**	**−0.17**	**−0.11**	**−0.13**	**−0.16**	**−0.13**
R^2	0.11	0.09	0.20	0.09	0.09	0.18	0.10	0.04	0.18	0.10	0.03	0.07	0.08	0.22	0.16	0.17	0.21	0.1
Valid count	2074	472	570	2014	1565	1726	3554	2003	1007	1576	1153	3114	2637	931	3866	3184	1655	
Total count	2967	1000	865	2502	1599	2143	3602	2003	1195	4487	1315	3500	2855	1247	5660	3360	2145	

Coefficients with p-values lower than 0.01 in bold.
Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of −0.005 to +0.005.
Limitations due to health problems: from severely limited (1) to not limited at all (3).
GEN-HL score: from 0=minimal HL to 100=maximal HL.
Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

Source: HLS19 Consortium

8.6 Discussion and conclusions

In summary, the three indicators of health are not only moderately correlated with General HL, but General HL has also moderate independent direct effects on these indicators, when potentially confounding independent variables are controlled for in a multivariable linear regression model. On average, the correlation ρ, the standardized regression coefficient β, and explained variance in the model R^2 is highest for self-perceived health (ρ=–0.21, β=–0.15, R^2=21%), followed by limitations due to health problems (ρ=0.18, β=0.14, R^2=10%), and by long-term illnesses/health problems (ρ=–0.14, β=–0.09, R^2=15%). A general trend was demonstrated for all countries, but for all three parameters there is also considerable variation across participating countries.

Limitations: Due to the limited standardization of the HLS_{19} study design (mainly the type and time of data collection) alongside the range in variation across countries, comparisons of the results between individual countries have not been described or interpreted in the International Report and must be interpreted with caution when undertaken selectively by the countries themselves.

The results can be compared with the HLS-EU results only to a certain degree: Although the same indicators were used for health status, General HL and one of the core determinants were measured differently, different methods of data collection were used, and mostly different countries were included in the two multinational studies.

» In the HLS-EU, all three health status indicators showed significant associations with HL, with a more pronounced one for self-perceived health (ρ=–0.27 on average vs. ρ=–0.21 in the HLS_{19}), followed by limitations due to health problems (ρ=0.17 vs. ρ=0.18 in the HLS_{19}) and the number of long-term illnesses/health problems (ρ=0.16 on average vs. ρ=–0.14 in the HLS_{19}).
» In the HLS-EU, in a multivariate linear regression model with five socio-demographic and socio-economic determinants of self-perceived health and the NVS Test, HL was the predictor with the second highest β on average (β=.17) following age (β=–.37).

Thus, in the HLS_{19} study the magnitude of most associations was, in general, slightly lower than in the HLS-EU study, which is probably a result of methodological differences between the two studies.

Conclusions

To the extent that this is possible with data from a cross-sectional study design, the HLS_{19} could demonstrate for more countries in the WHO European Region that General HL has moderate, significant effects on indicators of people's health status and is therefore relevant for public health policy in the WHO European Region as a critical determinant of health which is more easily modifiable than other determinants of health.

8.7 References

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9 General Health Literacy as a predictor of health care utilization

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9.1 Background

Previous research

In HL research, there is a tradition of analyzing the influence of HL on indicators relating to a person's or patient's utilization of health care. The literature published on the relationship between HL and the utilization of health care services has revealed different results for different types of health care services. Andrus/Roth (2002) found that low HL was associated with increased levels of hospitalization and increased costs of medical treatment. Betz et al. (2008) found inadequate HL was associated with higher rates of emergency room attendance. Berkman et al. (2011) published a systematic review on low HL and health outcomes. They showed that low HL was consistently associated with more hospitalizations and greater use of emergency care. According to Rasu et al. (2015), HL is inversely associated with health care utilization. In a review, Palumbo (2017) found that limited HL predicts increased hospitalization rates and improper use of health services. The French National Survey of Cancer Survivors also showed that limited HL is associated with greater use of primary care, particularly with the utilization of general practitioners (Ousseine et al. 2020). Friis et al. (2020) found that low HL for the general population predicted slightly more visits to general practitioners and admissions to hospital as well as longer hospitalization periods after 4 years of follow-up.

In the original HLS-EU study, indicators for four types of health services were investigated, for all of which significant Spearman correlations were demonstrated with General HL: physicians' visits ($\rho=-.11$ on average, varying across countries from $\rho=-.01$ to $\rho=-.19$), emergency services ($\rho=-.06$ on average, from $\rho=-.01$ to $\rho=-.15$), hospital services ($\rho=-.06$ on average, from $-.03$ to $-.19$), and other health professionals ($\rho=+.06$ on average, with inconsistent results with opposite signs) (HLS-EU Consortium 2012). For doctors' visits, a multivariable regression model with five socio-demographic and socio-economic determinants and General HL, which explained 13% of the variance on average (varying across countries from 3% to 23%), found General HL to be the third strongest predictor (significant at $\rho=-.07$ on average, significant for only three out of the eight countries and ranging from $\rho=-.07$ to $\rho=-.10$) (Pelikan/Ganahl 2017b).

In later research using the HLS-EU measurements for HL, Vandenbosch et al. (2016) found that low HL, as measured by the HLS-EU-Q16, is associated with greater use of healthcare services and especially of more specialized services. Using the HLS-EU-Q47, Berens et al. (2018) found that respondents with lower HL scores reported more frequent use of all four types of health services included. However, multiple regression analysis showed a direct significant effect of HL only on visits to doctors and other health professionals while no significant direct effect of HL on hospital and emergency services use was found when socio-demographic and health-related factors were controlled for.

Therefore, the HLS_{19} builds on the HLS-EU's generic model of HL (Sørensen et al. 2012) and the refined Vienna Model of Health Literacy (see Figure 1.2, Chapter 1) (Pelikan/Ganahl 2017a), which hypothesize that HL has direct effects on indicators of health care utilization. Thus, the guiding research question in the HLS_{19} for this chapter was whether there is a relevant, significant direct effect of General HL on the utilization of selected types of health care services but not how the variance in indicators relating to the utilization of health services can best be explained. However, given the cross-sectional nature of this study, the research question can be answered only in a limited, explorative way because the underlying causal assumptions cannot be tested empirically with the existing set of data.

Health care utilization in the HLS_{19}, and in comparison, with the HLS-EU

In the HLS-EU, health care utilization was measured by four indicators: use of emergency units, hospitals, physicians, and other healthcare professionals (HLS-EU Consortium 2012), (Sorensen et al. 2015). In comparison with the items and categories used in the HLS-EU, the items on health care utilization in the HLS_{19} were rephrased. While one item was used to measure visits to "doctors" in the HLS-EU (Q6.2), this rather broad and heterogeneous concept of "doctor" was divided into "GP or family doctor" and "medical or surgical specialist" in the HLS_{19} and measured by two, more specific items. Similarly, in the HLS-EU, one item was used to measure the utilization of "hospital services", and in the HLS_{19}, two items were used relating to inpatient and day patient hospital utilization separately.

Summing up, the variables used in the HLS_{19} for measuring health care utilization were:

» utilization of emergency services
» utilization of GPs/family doctors
» utilization of medical or surgical specialists
» utilization of inpatient hospital services
» utilization of day patient hospital services

Respondents were asked to provide the number of times they had utilized emergency services within the previous 24 months and all other services within the previous 12 months. (For detailed wording and response categories, see Table 9.1 in Annex 9.)

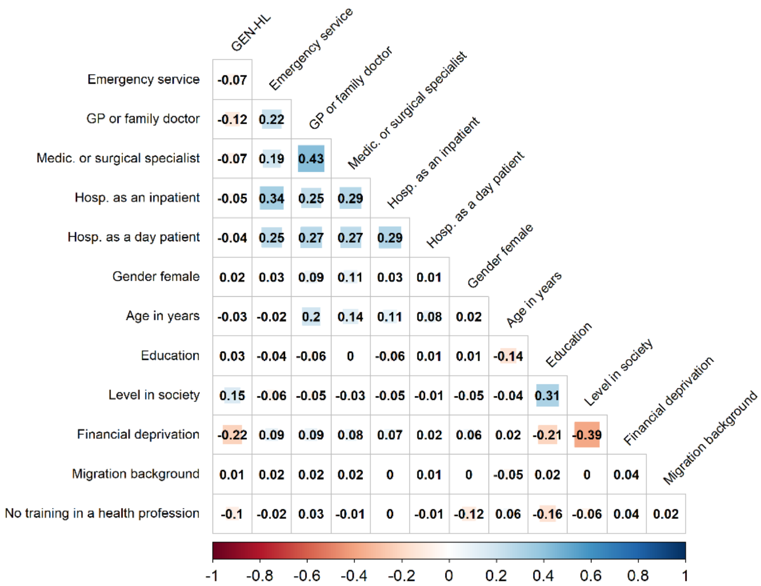
Data analyses and results are presented by:

» percentage distributions of health care utilization indicators (Annex 9),
» associations of health care utilization indicators with General HL (for all countries in the main chapter and for individual countries in Annex 9),
» Spearman correlations (ρ) among indicators of health care utilization, with General HL and selected socio-demographic and socio-economic determinants (for all countries in the main chapter and for individual countries in Annex 9),
» regression analyses: R^2 and standardized coefficients (β) of multivariable regression models are used to easily compare the relative importance of the predictors included, with the overall results in the main chapter and the results of models with unstandardized regression coefficients (b) in Annex 9.

9.2 Spearman correlations among indicators of health care utilization, with General HL and selected socio-demographic and socio-economic determinants

To give an idea of the relative strength of the relationships of the five indicators for health care utilization with each other, with General HL, and with potential common determinants as potential confounders and these with each other, Spearman correlations for the mean of all participating countries are provided in Figure 9.1. (For the distribution of the socio-demographic and socio-economic determinants see Chapter 6). Most of the correlations in Figure 9.1 are shown for individual countries in the annex to this chapter. On average, the five health care utilization indicators correlate with each other positively to a certain degree, from ρ=0.19 between the utilization of emergency services and medical or surgical specialists to ρ=0.43 between the utilization of GPs or family doctors and medical or surgical specialists.

Figure 9.1:
Spearman correlations (ρ) among indicators of health care utilization, with GEN-HL, and selected socio-demographic and socio-economic determinants, for all countries (equally weighted)*



* Values for the correlations with migration should be treated with caution as in five countries (BG, HU, IT, RU, and SK) the percentage of respondents with a migration background was below 10%, and the HLS19 survey as such was not adjusted to targeting migrants specifically (e.g., by offering translations of the instrument into migrant languages).

Source: HLS19 Consortium

General HL is negatively and weakly correlated with all five health care utilization indicators. The strongest correlation was, on average, with GPs or family doctors ($\rho=-0.12$), emergency services ($\rho=-0.07$), medical or surgical specialists ($\rho=-0.07$), hospitals as an inpatient ($\rho=-0.05$), and hospitals as a day patient ($\rho=-0.04$). However, the correlations of the health care utilization indicators with the five socio-demographic or socio-economic indicators are also rather weak on average, ranging from $\rho=0$ to a maximum of $\rho=0.2$ (Figure 9.1).

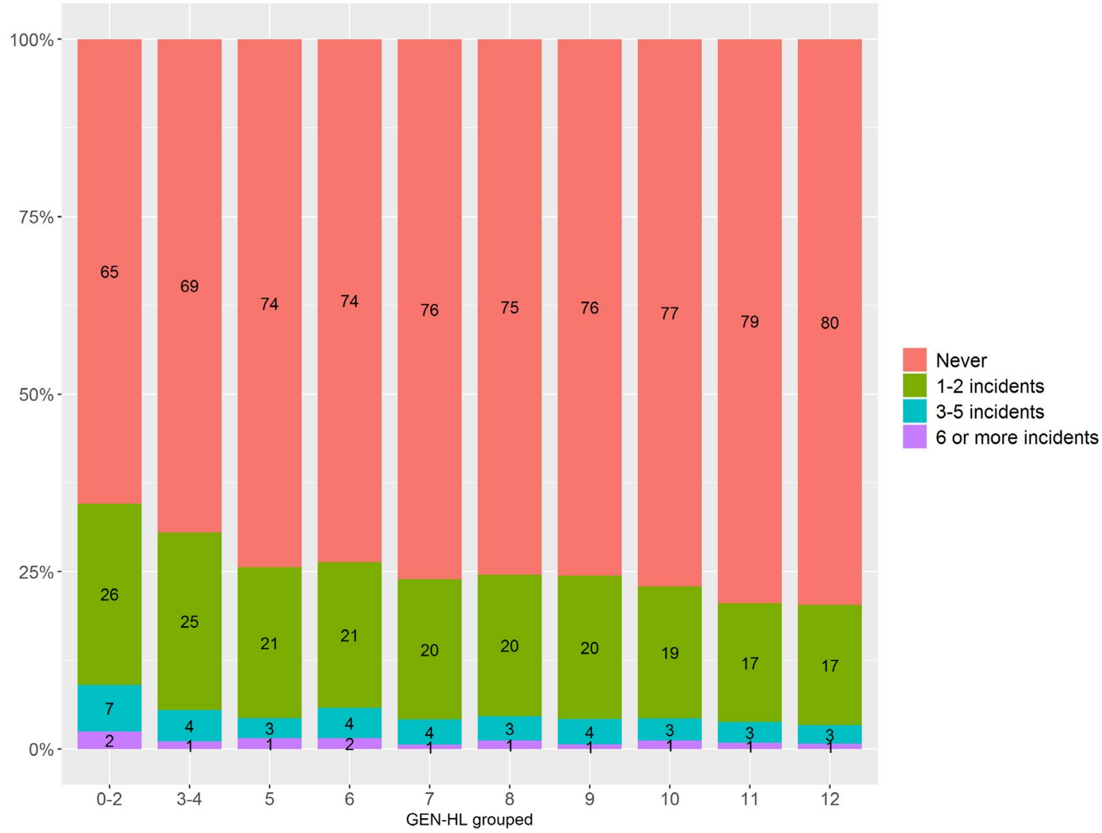
9.3 General HL and the utilization of emergency services

Across all participating countries, on average, 77% of the respondents had never used an emergency service in the previous 24 months, with 19% reporting 1–2 contacts (in figures indicated as incidents), 3% 3–5 contacts, and 1% six or more contacts. The variation between countries is moderate, with the lowest percentage for "never" used at 61% (PT) and the highest at 91% (BG) (cf. Figure A 9.1 in Annex 9).

On average, there is a rather linear, negative relationship between the frequency of utilization of emergency services with General HL – the higher the HL, the lower the use of emergency services (Figure 9.2) – but this relationship is not so smooth for individual countries (Annex 9, Figure A 9.2).

The correlation of General HL with the number of emergency service contacts is, at $\rho=-0.07$ on average (varying from $\rho=-0.02$ (CZ) to $\rho=-0.16$ (BG, PT)), the indicator with the second highest ρ value. "Financial deprivation" ($\rho=0.09$) is the indicator with the highest ρ and "level in society" ($\rho=-0.06$) is the indicator with the third highest ρ (Annex 9, Table A 9.2).

Figure 9.2:
Percentage distribution of four categories of <u>utilization of emergency services</u> by GEN-HL (10 groups from lowest HL to highest HL), for all countries (equally weighted)



Source: HLS19 Consortium

A multivariable linear regression model with standardized β coefficients was specified to explain the variation in the number of contacts with emergency services with the five socio-demographic and socio-economic determinants and General HL as predictors (for models with unstandardized b coefficients see Table A 9.3 in Annex 9).

The regression model explains, on average, only a small amount (2%) of the variation in emergency services use, varying between 1% (CH, DK, IT, and SI) and 11% (BG). However, General HL is, on average, the predictor with the second highest β=-0.06, (varying from β=-0.02 (DE, DK, and IT) to β=-0.2 (BG)), after financial deprivation (β=0.07) (Table 9.1). (For the same model with un-standardized coefficients (b) see Annex 9, Table A 9.3.)

Table 9.1:
Multivariable linear regression models of utilization of emergency services by GEN-HL and five core social determinants (standardized coefficients (β) and R^2), for each country and for all countries (equally weighted)

	AT	BE	BG	CH	CZ	DE	DK	FR	HU	IE	IL	IT	NO	PT	RU	SI	SK	All
GEN-HL	**−0.11**	**−0.08**	**−0.2**	−0.04	0.03	−0.02	−0.02	−0.03	−0.08	**−0.07**	−0.08	−0.02	−0.04	**−0.11**	**−0.09**	**−0.05**	**−0.11**	**−0.06**
Gender female	0.01	0.01	0.03	−0.02	−0.05	−0.02	0.01	−0.03	0.04	0	0.05	0	**0.06**	**0.11**	**0.09**	0	0.04	**0.03**
Age in years	0.05	**−0.12**	**−0.1**	−0.01	**−0.21**	**0.15**	0.01	**−0.12**	−0.01	**−0.1**	−0.05	0.02	0	−0.04	**0.12**	0.03	0.04	**−0.02**
Education	−0.01	−0.08	**−0.09**	−0.01	−0.03	−0.01	−0.03	0.03	−0.06	**−0.08**	0.04	0.04	**−0.05**	0.03	**−0.06**	−0.01	−0.06	**−0.03**
Level in society	−0.01	**−0.09**	−0.03	−0.05	0.01	−0.05	−0.03	0.02	0.02	−0.03	−0.05	0.01	0	0.05	−0.04	0.01	0.01	**−0.03**
Financial deprivation	**0.09**	−0.02	0.05	0.06	0.04	**0.1**	**0.08**	**0.09**	0.08	**0.1**	0.05	**0.11**	**0.12**	**0.16**	**0.09**	**0.06**	**0.07**	**0.07**
R^2	0.03	0.04	0.11	0.01	0.04	0.04	0.01	0.02	0.02	0.03	0.02	0.01	0.02	0.05	0.07	0.01	0.04	0.02
Valid count	2681	970	724	2019	1556	1824	3556	2003	1124	4295	1150	2825	2674	1168	4990	3175	1781	
Total count	2967	1000	865	2502	1599	2143	3602	2003	1195	4487	1315	3500	2855	1247	5660	3360	2145	

Coefficients with p-values lower than 0.01 in bold.
Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of −0.005 to +0.005.
Utilization of emergency services: number of contacts in the last 24 months, from 0 to 6 or more contacts.
GEN-HL score: from 0=minimal HL to 100=maximal HL.
Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

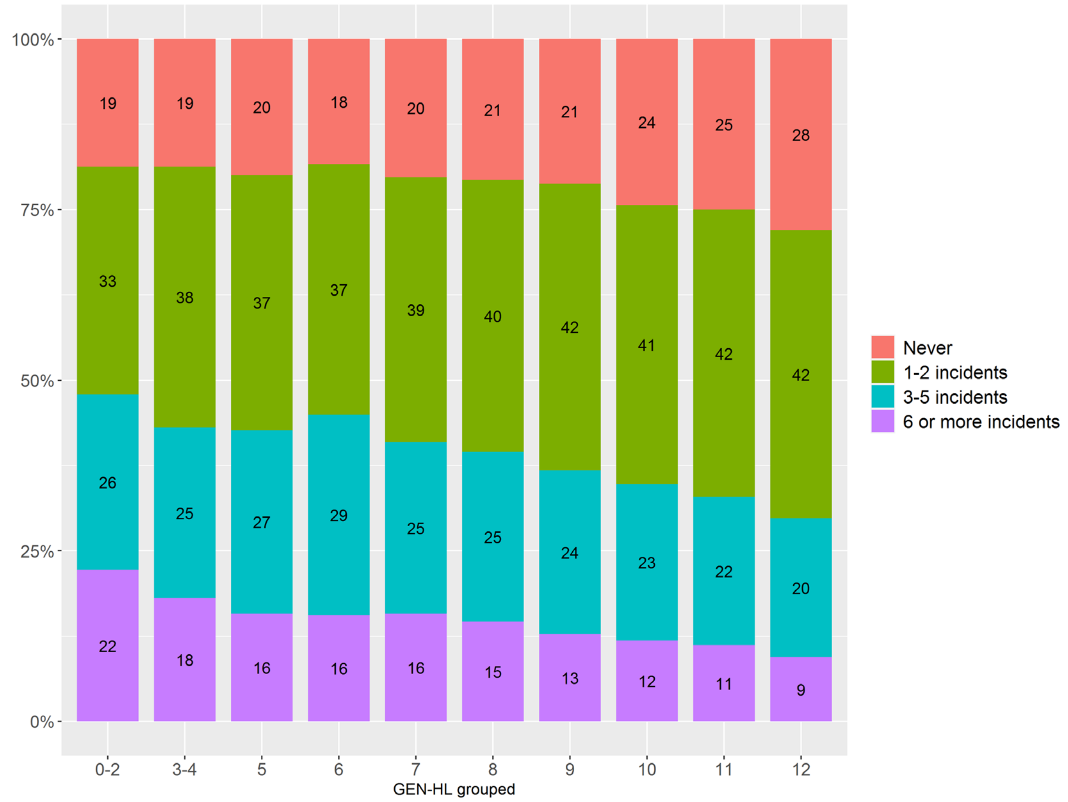
Source: HLS_{19} Consortium

9.4 General HL and the utilization of GPs/family doctors

Among the participating countries, on average, 23% of the respondents had never used a GP/family doctor in the previous 12 months, 41% had 1-2 contacts (in figures indicated as incidents), 23% 3-5 contacts, and 13% six or more contacts. There is quite some variation across countries, with the lowest proportion of "never" at 10% (BE) and highest at 41% (PT, RU) (Annex 9, Figure A 9.3).

On average there is a slight, negative, rather linear relationship between the frequency of utilization of GPs/family doctors and General HL. Respondents with higher General HL used this kind of service less often (Figure 9.3). Associations between the utilization of GPs/family doctors and General HL differ across countries (Annex 9, Figure A 9.4).

Figure 9.3:
Percentage distribution of four categories of utilization of GPs/family doctors by GEN-HL (10 groups from lowest HL to highest HL), for all countries (equally weighted)



Source: HLS$_{19}$ Consortium

The correlation with General HL is, at $\rho=-0.12$ (varying from $\rho=+0.03$ (CZ) to $\rho=-0.2$ (BG)), the second highest of the socio-demographic or socio-economic indicators. Age ($\rho=0.19$) has the highest correlation, and "financial deprivation" ($\rho=0.09$) is the predictor with the third highest ρ in the model (Annex 9, Table A 9.4).

A multivariable linear regression model with standardized β coefficients was built to explain the variation in the number of contacts with GPs/family doctors, with the five socio-demographic and socio-economic determinants and General HL as predictors. (For a model with unstandardized b coefficients, see Table A 9.5 in Annex 9).

This model for the utilization of GPs/family doctors explains somewhat more variation than that for emergency services with an average of 6% (varying from 4% (DK, IL) to 15% (RU)). General HL is, with an average of $\beta=-0.09$ (varying from $\beta=0$ (IL, IT) to $\beta=-0.14$ (BG)), the predictor with the second highest ß of utilization of GPs/family doctors after age ($\beta=0.18$). Female gender ($\beta=0.08$) and financial deprivation ($\beta=0.05$) are the predictors with the third and fourth highest ß (Table 9.3). (For the same model with unstandardized coefficients (b), see Annex 9, Table A 9.5.)

Table 9.2:
Multivariable linear regression models of utilization of GPs/family doctors by GEN-HL and five core social determinants (standardized coefficients (β) and R^2), for each country and for all countries (equally weighted)

	AT	BE	BG	CH	CZ	DE	DK	FR	HU	IE	IL	IT	NO	PT	RU	SI	SK	All
GEN-HL	**−0.07**	−0.03	**−0.14**	**−0.08**	0.01	**−0.06**	**−0.05**	−0.05	−0.02	**−0.06**	0	0	−0.04	**−0.09**	**−0.09**	**−0.06**	−0.04	**−0.09**
Gender female	**0.1**	**0.08**	0.03	0.02	−0.01	**0.08**	**0.09**	**0.08**	**0.13**	**0.15**	**0.08**	0.02	**0.15**	**0.14**	**0.06**	**0.07**	**0.07**	**0.08**
Age in years	**0.22**	**0.16**	**0.16**	**0.18**	**0.17**	**0.31**	**0.09**	**0.19**	**0.26**	**0.14**	0.04	**0.23**	**0.08**	**0.13**	**0.29**	**0.17**	**0.23**	**0.18**
Education	0	**−0.18**	**−0.19**	−0.03	**−0.09**	−0.02	−0.02	0	0	−0.02	−0.08	−0.02	**−0.11**	−0.03	0.01	0	−0.05	**−0.02**
Level in society	0.03	−0.06	−0.07	**−0.07**	−0.01	−0.05	**−0.09**	−0.01	0	**−0.06**	0.02	−0.05	0.01	0.01	−0.04	0.02	0.01	−0.01
Financial deprivation	**0.09**	−0.01	**−0.13**	**0.08**	**0.12**	**0.09**	**0.06**	**0.09**	**0.09**	**0.1**	**0.14**	**0.07**	**0.12**	0.06	**0.11**	**0.11**	**0.18**	**0.05**
R^2	0.09	0.09	0.1	0.06	0.06	0.14	0.04	0.05	0.11	0.06	0.04	0.07	0.05	0.07	0.15	0.06	0.14	0.06
Valid count	2646	981	724	2019	1548	1794	3552	2003	1123	4286	1156	2931	2665	1168	4920	3177	1785	
Total count	2967	1000	865	2502	1599	2143	3602	2003	1195	4487	1315	3500	2855	1247	5660	3360	2145	

Coefficients with p-values lower than 0.01 in bold.
Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of −0.005 to +0.005.
Utilization of GPs/family doctors: number of contacts in the last 12 months, from 0 to 6 or more contacts.
GEN-HL score: from 0=minimal HL to 100=maximal HL.
Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

Source: HLS_{19} Consortium

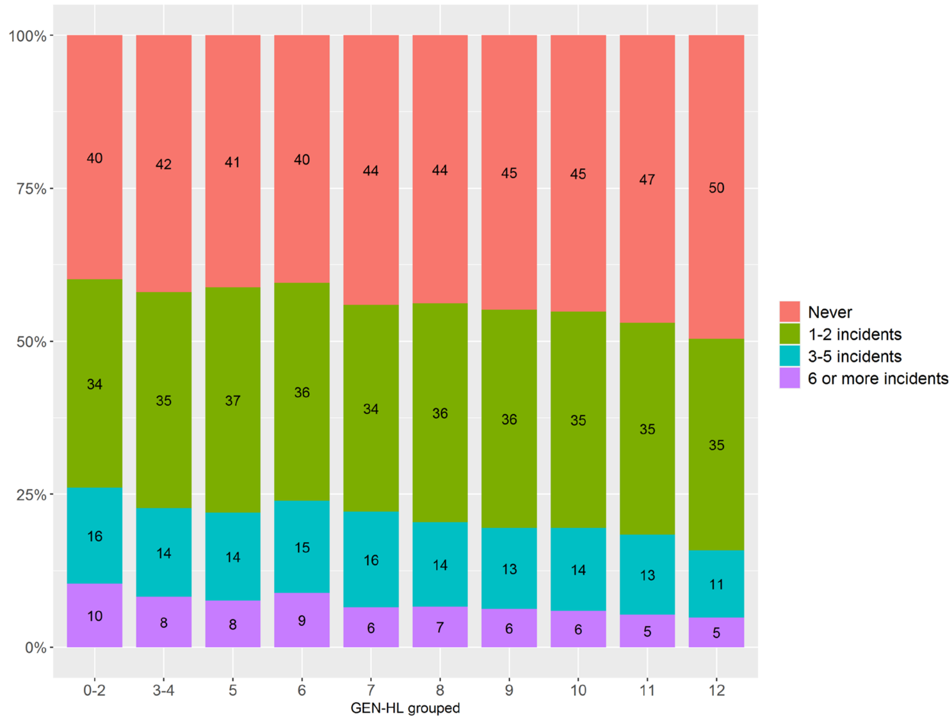
9.5 General HL and the utilization of medical or surgical specialists

On average among the participating countries, 46% of respondents had never used a medical or surgical specialist within the previous 12 months, 35% had 1–2 contacts (in figures indicated as incidents), 13% 3–5 contacts, and 6% 6 or more contacts. The utilization of medical and surgical services varies considerably by country, for example, "never" ranged from 26% (AT) to 72% (NO) (Annex 9, Figure A 9–5).

The utilization of medical or surgical specialists (for the percentage distribution, see Annex 9, Figure A 9.5) is, on average, slightly and rather linearly related to General HL. With better General HL there is, on average, a slight decrease in the frequency of utilization of medical or surgical specialists (Table 9.4). This kind of association can be found in most participating countries but to a differing degree and a few deviations (Annex 9, Figure A 9.6).

General HL is, on average, negatively correlated with the utilization of medical or surgical specialists with $\rho=-0.07$ (varying from $\rho=+0.03$ (BE) to $\rho=-0.16$ (RU)) and thereby it is the predictor with the fourth highest ρ value. The highest ρ value has age ($\rho=0.14$), followed by female gender ($\rho=0.1$) and financial deprivation (0.08) (Annex 9, Table A 9.6).

Figure 9.4:
Percentage distribution of four categories of utilization of medical or surgical specialists by GEN-HL (10 groups from lowest HL to highest HL), for all countries (equally weighted)



Source: HLS_{19} Consortium

A multivariable linear regression model with standardized β coefficients was built to explain the variation in the frequency of contacts with emergency services with the five socio-demographic and socio-economic determinants and General HL as predictors. (For a model with unstandardized b coefficients, see Annex 9, Table A 9-7).

The model including General HL and socio-demographic and socio-economic determinants explains on average just 3% of the variation in the utilization of medical and surgical specialists (varying between 1% (NO) and 12% (DE)). General HL is, at β=-0.05 (varying from β=+0.02 (BE) to β=-0.1 (RU)), the predictor with the fourth highest ß for the utlization of medical and surgical specialists, followed by age (β=0.12), female gender (β=0.09), and financial deprivation (β=0.07) (Table 9.3). (For the same model with unstandardized coefficients (b), see Annex 9, Table A 9.7.)

Table 9.3:
Multivariable linear regression models of utilization of medical or surgical specialists by GEN-HL and five core social determinants (standardized coefficients (β) and R^2), for each country and for all countries (equally weighted)

	AT	BE	BG	CH	CZ	DE	DK	FR	HU	IE	IL	IT	NO	PT	RU	SI	SK	All
GEN-HL	−0.03	0.02	−0.04	−0.05	−0.03	**−0.08**	**−0.05**	**−0.06**	−0.02	−0.04	−0.07	−0.02	0	−0.02	**−0.10**	−0.01	−0.04	**−0.05**
Gender female	**0.21**	**0.14**	0.07	**0.08**	**0.12**	**0.1**	**0.06**	**0.14**	**0.11**	0.02	**0.09**	**0.07**	0.03	**0.14**	**0.05**	**0.06**	**0.09**	**0.09**
Age in years	**0.11**	**0.16**	−0.03	**0.11**	**0.16**	**0.28**	**0.09**	**0.13**	**0.11**	**0.13**	**0.21**	**0.13**	**0.08**	**0.11**	**0.11**	**0.16**	**0.25**	**0.12**
Education	**0.1**	−0.04	**−0.11**	**0.11**	0.06	0.06	0.04	**0.1**	**0.14**	0.03	**0.09**	**0.14**	0	**0.17**	**0.09**	**0.08**	0.02	**0.03**
Level in society	0	**−0.09**	−0.03	**−0.07**	−0.02	−0.04	0	0.04	−0.01	**−0.06**	−0.03	0.03	−0.01	0.03	**−0.06**	0	−0.01	−0.01
Financial deprivation	**0.06**	0.06	−0.09	**0.12**	0.06	**0.08**	**0.08**	**0.09**	**0.16**	**0.04**	0.08	0.05	**0.06**	0.04	**0.06**	**0.07**	0.06	**0.07**
R^2	0.07	0.06	0.03	0.05	0.04	0.12	0.02	0.05	0.07	0.03	0.08	0.03	0.01	0.05	0.05	0.04	0.09	0.03
Valid count	2657	971	724	2017	1546	1817	3552	2003	1124	4292	1155	2932	2672	1168	4901	3172	1787	
Total count	2967	1000	865	2502	1599	2143	3602	2003	1195	4487	1315	3500	2855	1247	5660	3360	2145	

Coefficients with p-values lower than 0.01 in bold.
Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of −0.005 to +0.005.
Utilization of medical or surgical specialists: number of contacts in the last 12 months, from 0 to 6 or more contacts.
GEN-HL score: from 0=minimal HL to 100=maximal HL.
Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

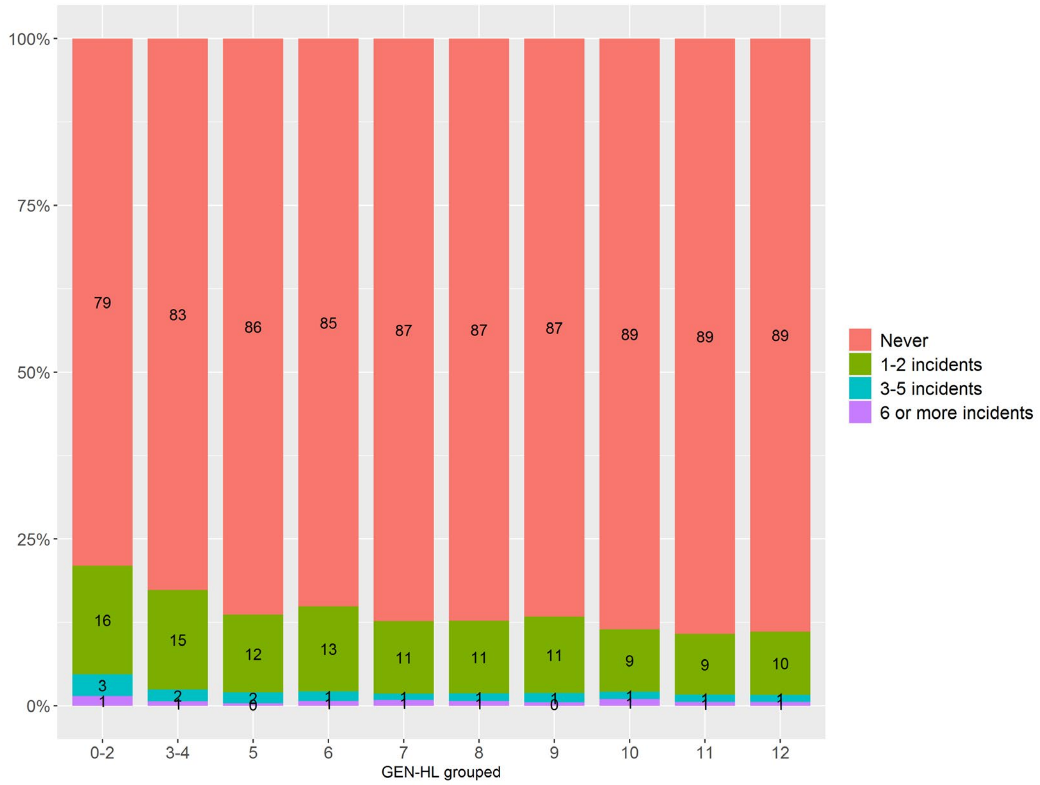
Source: HLS_{19} Consortium

9.6 General HL and the utilization of inpatient hospital services

On average among the participating countries, inpatient hospital services had never been used by 87% of the respondents within the previous 12 months, 11% had 1–2 contacts (in figures indicated as incidents), and 1% either 3–5 or 6 or more contacts. The variation across countries is moderate for "never", ranging from 82% (DE) to 92% (IT, PT) (Annex 9, Figure A 9.7).

The utilization of inpatient hospital services (for the percentage distributions see Annex 9, Figure A 9.7) has, on average, a very slight, rather linear, negative relation with General HL (Figure 9.5) with very few countries deviating from this trend (Annex 9, Figure 9.8).

Figure 9.5:
Percentage distribution of four categories of utilization of inpatient hospital services by GEN-HL (10 groups from lowest HL to highest HL), for all countries (equally weighted)



Source: HLS$_{19}$ Consortium

The correlation with General HL is, on average, negative and rather small at ρ=−0.05 (varying from ρ=0.01 (CZ) to ρ=−0.14 (SK)) and was thus the predictor with the fourth highest ρ (together with level in society) after age (ρ=0.11), education (ρ=–0.06), and financial deprivation (ρ=0.07) (Annex 9, Table A 9.8).

A multivariable linear regression model with standardized β coefficients was calculated to explain the variation in the frequency of emergency service utilization with the five socio-demographic and socio-economic determinants and General HL as predictors. (For a model with unstandardized coefficients (b), see Table A 9.9 in Annex 9.)

The multivariable regression model explains, on average, just 2% of the variance in the use of inpatient hospital services (varying from 0% (CZ) to 9% (SK)). At β=–0.04 (varying from β=+0.01 (NO) to β=–0.08 (BG)), General HL is, on average, the predictor with the third highest ß (together with education, after age (β=0.09) and financial deprivation (β=0.06)) (Table 9.4). (For the same model with unstandardized coefficients (b), see Annex 9, Table A 9.9.)

Table 9.4:
Multivariable linear regression models of utilization of inpatient hospital services by GEN-HL and five core social determinants (standardized coefficients (β) and R^2), for each country and for all countries (equally weighted)

	AT	BE	BG	CH	CZ	DE	DK	FR	HU	IE	IL	IT	NO	PT	RU	SI	SK	All
GEN-HL	**−0.06**	−0.01	−0.08	−0.05	0	**−0.06**	−0.01	0.03	−0.05	**−0.05**	−0.05	−0.01	0.01	−0.06	**−0.06**	−0.02	−0.06	**−0.04**
Gender female	0.03	0.04	0.01	0.02	0.02	0	0	−0.03	0.02	0	0.04	**−0.05**	**0.05**	0.05	0.02	−0.02	0.02	**0.01**
Age in years	**0.08**	0.06	**0.1**	**0.11**	0.04	**0.2**	**0.1**	−0.01	**0.15**	0.04	0.02	0.05	**0.12**	**0.12**	**0.12**	**0.11**	**0.19**	**0.09**
Education	−0.04	**−0.1**	**−0.21**	−0.03	−0.02	−0.04	0	0.03	−0.06	**−0.08**	−0.05	0.01	**−0.07**	−0.01	**−0.06**	−0.02	−0.05	**−0.04**
Level in society	−0.04	−0.04	−0.02	**−0.08**	0.02	−0.03	−0.01	0.05	0	−0.02	−0.01	**0.06**	0.04	0.05	0.02	−0.04	−0.03	−0.01
Financial deprivation	0.03	0.06	−0.02	0.04	0.03	0.05	**0.08**	0.06	0.03	**0.08**	0.02	**0.12**	**0.08**	0.03	**0.06**	0.05	**0.1**	**0.06**
R^2	0.02	0.02	0.07	0.03	0	0.06	0.02	0.01	0.04	0.02	0.01	0.01	0.03	0.02	0.03	0.03	0.09	0.02
Valid count	2679	968	724	2020	1564	1830	3561	2003	1124	4295	1147	2947	2681	1168	5043	3173	1787	
Total count	2967	1000	865	2502	1599	2143	3602	2003	1195	4487	1315	3500	2855	1247	5660	3360	2145	

Coefficients with p-values lower than 0.01 in bold.
Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of −0.005 to +0.005.
Utilization of inpatient hospital services: number of contacts in the last 12 months, from 0 to 6 or more contacts.
GEN-HL score: from 0=minimal HL to 100=maximal HL.
Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

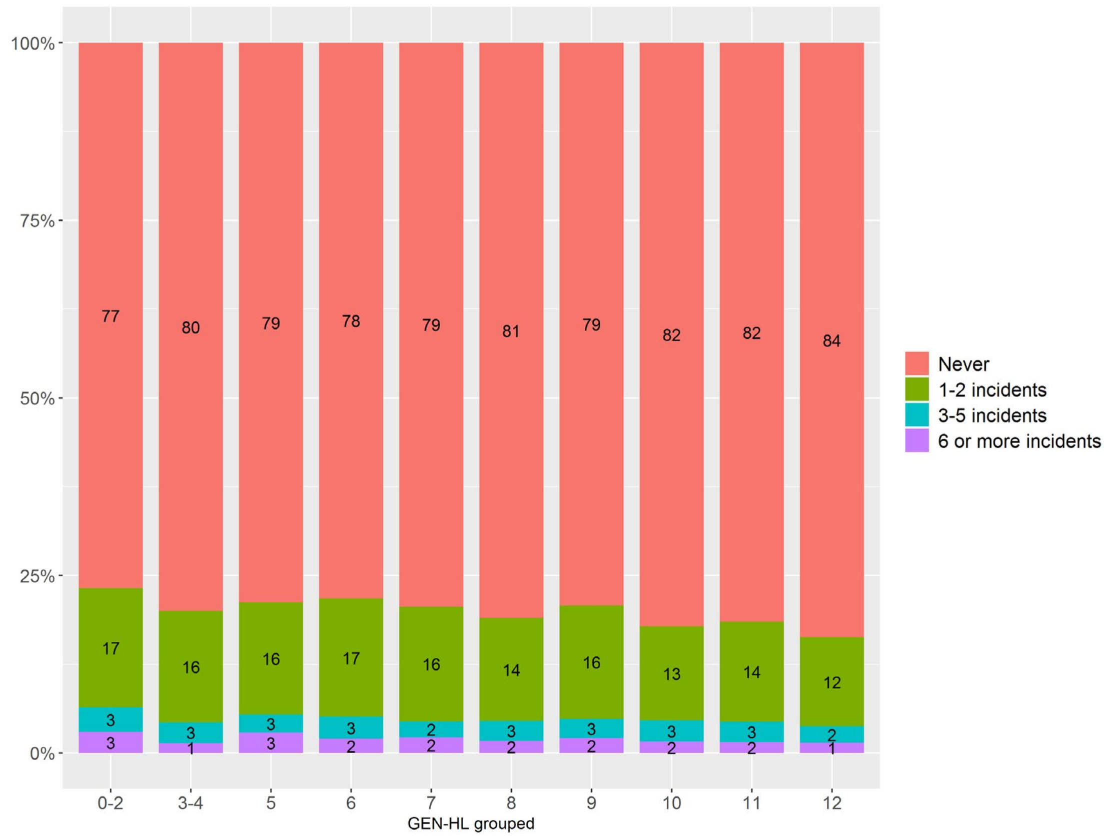
Source: HLS_{19} Consortium

9.7 General HL and the utilization of day patient hospital services

On average, among the participating countries, day patient hospital services had never been by 81% of respondents within the previous 12 months, with 14% reporting 1–2 contacts (in figures indicated as incidents), 3% 3–5 contacts, and 2% 6 or more contacts. There is considerable variation across countries, for example, for “never” from 65% (DK) to 93% (PT) (Annex 9, Figure A 9.9).

On average there is no association between the frequency of day patient hospital service utilization and General HL and it is otherwise somewhat irregular (Figure 9.6). There are also no associations for individual countries, with just a few rather irregular cases (Annex 9, Figure A 9.10).

Figure 9.6:
Percentage distribution of four categories of utilization of day patient hospital services by GEN-HL (10 groups from lowest HL to highest HL), for all countries (equally weighted)



Source: HLS19 Consortium

The correlation with General HL is, on average, at $\rho=-0.04$ (varying from $\rho=-0.01$ (DE) to $\rho=-0.11$ (RU)), almost as weak as for the utilization of inpatient hospital services and thus it is the predictor with the second highest ρ in the model, after age ($\rho=0.08$) (Annex 9, Table A 9.10).

A multivariable linear regression model with standardized β coefficients was built to explain the variation in the frequency of use of day patient hospital services with the five socio-demographic and socio-economic determinants and General HL as predictors (for a model with unstandardized coefficients (b), see Table A 9.11 in Annex 9).

The model explains, on average, just 1% of the variation (from 1% (CZ, FR, HU, IL, and SI) to 4% (BE, RU), which is even lower than for the utilization of inpatient hospital services. General HL is, on average, at a value of $\beta=-0.04$ (varying from $\beta=0$ (DE, IL) to $\beta=-0.07$ (HU)), the predictor with the second highest ß in the model, after age ($\beta=0.08$) (Table 9.5). (For the same model with unstandardized coefficients (b), see Annex 9, Table A 9.11.)

Table 9.5:

Multivariable linear regression models of utilization of day patient hospital services by GEN-HL and five core social determinants (standardized coefficients (β) and R^2), for each country and for all countries (equally weighted)

	AT	BE	BG	CH	CZ	DE	DK	FR	HU	IE	IL	IT	NO	PT	RU	SI	SK	All
GEN-HL	−0.04	−0.02	−0.03	−0.02	−0.03	0	−0.01	−0.04	−0.07	**−0.04**	0	−0.03	−0.01	−0.05	**−0.06**	−0.03	−0.05	**−0.04**
Gender female	0.01	0.06	**−0.11**	−0.01	0	−0.02	**0.05**	−0.03	0.01	0.02	0	−0.05	**0.06**	0.02	**0.07**	−0.03	0.04	0.01
Age in years	**0.11**	**0.11**	0.02	**0.12**	−0.03	**0.12**	**0.12**	0.05	0.01	**0.12**	0.05	0.03	**0.11**	**0.11**	**0.12**	**0.06**	**0.09**	**0.08**
Education	−0.03	−0.05	**−0.14**	0.04	−0.02	0.04	−0.02	0.05	0.01	0	**−0.1**	0	−0.03	−0.05	0.01	0.02	−0.03	**0.02**
Level in society	0.02	**−0.11**	0.01	**−0.09**	−0.01	0	−0.03	−0.01	−0.01	**−0.04**	0.01	**0.06**	−0.02	**0.11**	**−0.05**	−0.02	0	−0.01
Financial deprivation	**0.07**	0.04	−0.05	0.03	0.06	**0.09**	**0.06**	0.05	0.03	**0.07**	0.02	**0.13**	**0.06**	0.04	0.04	0.03	**0.08**	0.01
R^2	0.03	0.04	0.03	0.02	0.01	0.02	0.03	0.01	0.01	0.03	0.01	0.02	0.02	0.03	0.04	0.01	0.03	0.01
Valid count	2679	964	724	2018	1565	1830	3561	2003	1123	4299	1152	2957	2671	1168	5021	3173	1781	
Total count	2967	1000	865	2502	1599	2143	3602	2003	1195	4487	1315	3500	2855	1247	5660	3360	2145	

Coefficients with p-values lower than 0.01 in bold.

Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of −0.005 to +0.005.

Utilization of day patient hospital services: number of contacts in the last 12 months, from 0 to 6 or more contacts.

GEN-HL score: from 0=minimal HL to 100=maximal HL.

Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).

Level in society from 1=lowest level to 10=highest level in society.

Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

Source: HLS_{19} Consortium

9.8 Discussion and conclusions

Summarizing, the correlations of General HL with the utilization of selected health services were, on average and as expected, negatively but rather weakly correlated with all five health care utilization indicators. The strongest correlation was, on average, with GPs/family doctors ($\rho=-0.12$), followed by emergency services ($\rho=-0.07$), medical or surgical specialists ($\rho=-0.07$), inpatient hospital services ($\rho=-0.05$), and day patient hospital services ($\rho=-0.04$).

In multivariable linear regression models with five used socio-demographic and socio-economic indicators which have been shown to be predictors of HL as potential confounders, the β values for the potential effect of General HL on the utilization of health services were, on average, compared to the other correlations somewhat lower for emergency services (on average $\beta=-0.06$, significant for eight countries with β ranging from −0.05 to −0.20), GPs/family doctors (on average $\beta=-0.09$, significant for nine countries with β ranging from −0.05 to −0.14), medical and surgical specialists (on average $\beta=-0.05$, significant only for four countries with β ranging from −0.05 to −0.10), hospital inpatients (on average $\beta=-0.04$, only four countries significant with β ranging from −0.05 to −0.06) and hospital day patients (on average $\beta=-0.04$, significant only for two countries with $\beta=-0.04$ or −0.06). Thus, for the utilization of emergency services and GPs/family doctors, there is a stronger and more significant trend for more countries that General HL negatively affects the utilization of these health services, while for the other indicators significant effects were only demonstrated for a few countries.

Limitations: Due to the limited standardization of the HLS_{19} study design (mainly the type and time of data collection), alongside overall trends and the range in variation across countries, comparisons of the results between individual countries have not been described or interpreted in the International Report and must be interpreted with caution when undertaken selectively by the countries themselves.

Comparison with the results of the HLS-EU is further limited by changes in the measure of General HL, by fewer measures and changes in all measures of the utilization of health services as well as in one of the core socio-demographic and socio-economic determinants, and by mostly different countries included in the two studies.

The results of the HLS_{19} fit in rather well with already demonstrated trends, even if the values for correlations, β coefficients, and explained variance are somewhat lower in the HLS_{19} compared to the HLS-EU. Comparison with other publications is even more difficult due to methodological differences in other published studies.

In conclusion, the HLS_{19} enriched the evidence for more countries in the WHO European Region that General HL is relevant for at least for two, i.e., utilization of GPs/family doctors and emergency services, out of the five selected indicators of the utilization of health services, as far as this is possible to claim with data from a cross-sectional study design. In conclusion, HL is relevant for health policy and practice in the WHO European Region.

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10 Navigational Health Literacy

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10.1 Background and development of instrument

10.1.1 Overview of the relevance, existing research, and measures of Navigational Health Literacy

Already in 2001, the Institute of Medicine stated in their report *Crossing the Quality Chasm: A New Health System for the 21st Century* that the situation in healthcare is "characterized by more to know, more to manage, more to watch, more to do, and more people involved in doing it than at any time in the nation's history" (Institute of Medicine Committee on Quality of Health Care in America 2001: 25). This description still holds true for many healthcare systems and in fact even more strongly today than 20 years ago. Generally, positive efforts in science and technology have led to a high degree of specialization in healthcare systems. At the same time, healthcare systems have become more complex, and increasingly fragmented structures have led to coordination and interaction challenges for health professionals and healthcare users alike. But especially for patients and users, these challenges can be demanding. Users are required to orientate themselves within a large service landscape, to maneuver between and within various healthcare organizations and to interact with a range of different health professions to plan and negotiate further health care. However, meeting such demands is not always easy, and if not achieved, the consequences for the individual (and for the healthcare system) are considerable. Fruitless searches, discontinuities in health care, and, subsequently, uncertainties and burdens for patients are just some of the consequences of failing healthcare navigation (Ørtenblad et al. 2018; Schaeffer 2017; Snelgrove/Liossi 2013; Dow et al. 2012). To deal with the numerous challenges posed to patients and users by healthcare systems as well as by their structures, norms, and functions, health literacy, or more concretely, specific HL for navigating healthcare systems is needed.

Whereas the increasing complexity, fragmentation, and resulting problems have long been discussed and investigated in different countries (e.g. Ellen et al. 2018; SVR Economy 2017; WHO 2016; Hofmarcher et al. 2007; SVR 2007; Schaeffer 2004), the difficulties encountered by patients and users when dealing with information on navigational issues in healthcare systems have rarely been systematically considered. One exception is the work of Rima Rudd and colleagues (Groene/Rudd 2011; Rudd/Anderson 2006; Rudd et al. 2004; Rudd 2004), which early drew attention to the importance of HL in the context of navigation. As early as 2004, in a qualitative exploratory study, Rudd showed how demanding navigation tasks within hospitals can be. According to Rudd (2004: 23), health organizations, i.e., hospitals, represent "literate environments" which require literacy skills, e.g., reading and understanding signs and maps but also interactional skills to receive assistance with directions to orientate oneself within and navigate these organizations. In quantitative research, to our knowledge, the topic of Navigational HL was first addressed in the study *Literacy and Health in America* (Rudd et al. 2004), which built on a synthesis of health-related data from the National Adult Literacy Survey (NALS) and the International Adult Literacy Survey (IALS). In this study, literacy tasks related to rights and responsibilities, insurance applications and other coverage plans, and informed consent for procedures and studies were classified as one of five HL activities – entitled "Systems Navigation" – in the underlying Health Activities Literacy Scale (HALS) (Rudd et al. 2004: 8).

In the following years, the topic was also addressed in further studies. These studies, however, focused less on the competences and abilities needed to deal with information but more on those directly required to navigate the healthcare system, also referred to as "navigation competencies" (Gui et al. 2018: 6), which are usually considered an outcome of HL (e.g., Paasche-Orlow/Wolf, (2007)). In this regard, there are quantitative studies relating HL to aspects which are linked to the topic of navigation topic, such as delays in or foregoing needed care, difficulties in finding a provider, or in navigating and coordinating care for the elderly (Fields et al. 2018; Levy/Janke 2016) but studies and measurements describing HL regarding the specific field of navigating healthcare systems are still extremely rare.

One exception is the work by Osborne and colleagues: the authors conceptualized "navigating the healthcare system" as one of nine subdimensions of HL (Osborne et al. 2013: 8) and developed a corresponding subscale in the Health Literacy Questionnaire (HLQ) outlining the ability to find out about services and support as well as to advocate in the healthcare system on one's own behalf. However, the navigation scale in the HLQ only partly reflects a complex definition of HL (especially the steps of information processing it defines) on which a comprehensive understanding of HL and the current study is based (HLS-EU Consortium 2012; Sørensen et al. 2012). To the best to our knowledge, apart from the small number of works mentioned, there are no studies and measurement tools on HL in the specific field of navigating healthcare systems.

10.1.2 Arguments for providing a new measure and the procedure for developing a measure for Navigational HL

Most findings connecting HL to navigation issues are based on a general assessment of health literacy as described above. Data on HL displaying the specific information challenges faced when navigating healthcare systems – conceptualized in this report as *Navigational Health Literacy (Navigational HL)* – are missing. Due to the limited amount of research as well as the few attempts at conceptualizing and operationalizing Navigational HL, the HLS_{19} aimed to develop and include a new definition and associated instrument: the HLS_{19}-NAV.[4]

With the objective of conceptualizing Navigational HL in this study against the background of a comprehensive understanding of HL, a definition of Navigational HL was developed during the preparations for the HLS_{19}. This definition was based on a scoping literature review of existing definitions, concepts, and instruments in the field of navigation with a special focus on HL. It was also related to the integrative definition of HL in the HLS-EU (HLS-EU Consortium 2012; Sørensen et al. 2012). As a result, Navigational HL is defined as *people's knowledge, motivation and skills to access, understand, appraise and apply the information and communication in various forms*

4 This assumption is based on a scoping review of the literature. Its results and the subsequent steps in defining and conceptualizing Navigational HL as well as the process of instrument development can be found in detail in Griese et al. (2020).

necessary for navigating healthcare systems and services adequately to get the most suitable health care for oneself or related persons. (Griese et al. 2020: 6)

With reference to the underlying model of HL (Sørensen et al. 2012) – in which HL is conceptualized in the three domains of *Health Care*, *Disease Prevention*, and *Health Promotion* – in this study, Navigational HL primarily focuses on the domain of health care. Although Navigational HL is also required in the context of disease prevention and health promotion, and in other contexts as well, such as rehabilitation or nursing care, it can be assumed that a large proportion of the navigational requirements for patients will arise in the domain of health care.

In this regard Navigational HL is needed on three levels:

» **a macro, systemic level** (e.g., how is the health system organized, how does it function and work?),
» **a meso, organizational level** (e.g., which service organization functions in which way, who is the right contact person there, and what are the rules for using it?), and
» **a micro, interactional level** (e.g., how to interact with and communicate one's own problems to health professionals in such a way that a workable solution for making use of health services can be jointly discussed and agreed upon). [5]

At this point, it should also be emphasized that Navigational HL refers to the information requirements related to securing and shaping health care. Questions regarding aspects of treatment and therapy (cures) are not considered here.

Like HL, Navigational HL can be understood as a relational concept (Parker 2009), i.e., it is related to both personal abilities to access, understand, appraise, and apply information on navigational issues (individual or personal Navigational HL) as well as the social, systemic, and contextual circumstances (organizational Navigational HL or responsiveness) in which information on the healthcare system is provided and within which Navigational HL is acquired. Furthermore, the term navigation is defined in this chapter as regarding navigation within a more topographical area (the healthcare system, its organizations, and proceedings). However, the term has also been used in many other contexts in the meantime, e.g., the navigation of digital environments and information sources (Bittlingmayer et al. 2020; Levin-Zamir/Bertschi 2018). These aspects are further examined in the chapter on Digital HL (Chapter 12).

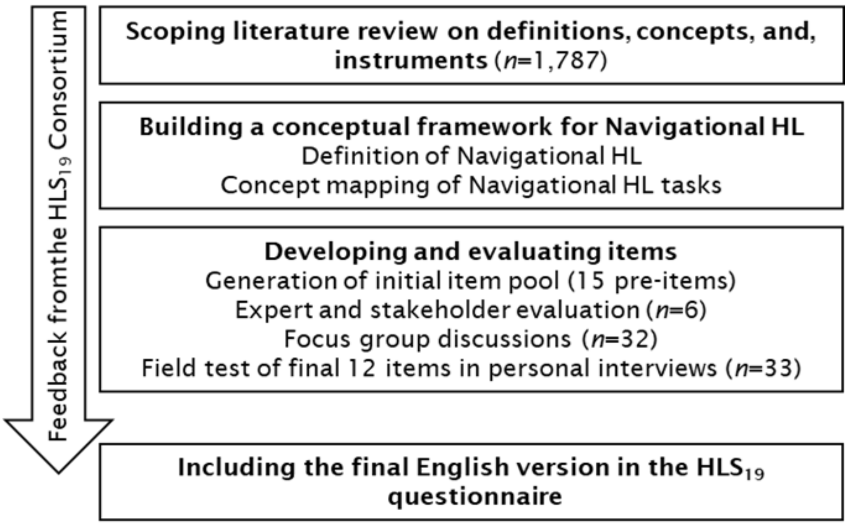
As for the development of the other optional packages, a working group on measuring Navigational HL was initiated, led by the first and second authors of this chapter. Representatives from the HLS_{19} countries interested in developing and using the package Navigational HL were invited to join the working group at an early stage of the preparations for the HLS_{19}. In the end, seven

[5] Since health literacy relating to communication with physicians in health care services (HL-COM) is treated as an autonomous concept and measure in this study (Chapter 11), it was decided to cover the interactive/communicative level of Navigational HL with just one item (HLS19-NAV12). Nevertheless, it is assumed that HL-COM is also important for patients to negotiate health care and healthcare paths and is therefore a prerequisite for navigating healthcare systems and Navigational HL.

experts from Germany, Austria, Switzerland, Norway, Portugal, and the Czech Republic were involved.

The detailed procedure for developing the instrument is shown in Figure 10.1. It is based on a scoping review of the literature on existing definitions, concepts, and instruments on navigation in healthcare systems with special regard to HL, developing a conceptual framework, formulating the first items formation and item evaluation.

Figure 10.1:
Steps in the development of the HLS$_{19}$-NAV (in accordance with Griese et al., 2020, p. 3)



Source: Griese et al., 2020, p. 3

The item formation step also included alignment with the HLS-Q47 items. Since item Q4 in the HLS$_{19}$-Q47 also refers to the navigation topic ("to find out where to get professional help when you are ill"), it was decided not to include this item in the HLS$_{19}$-NAV. Furthermore, the wording of item Q35 in the HLS-Q47 in the subdimension of HL for health promotion (HP-HL) is roughly reflected in item HLS$_{19}$-NAV4 ("to understand information on ongoing health care reforms that might affect your health care"). However, the wording was modified in such a way that it focuses on reforms in the field of health care and is thus much narrower than item Q35 in the HLS-Q47, which only refers to health in general. An overlap between these items can also be excluded because item Q35 in the HLS-Q47 is not part of the HLS$_{19}$-Q12 measure used in this study.

To evaluate the items, the initial item pool was tested in four focus groups in relation to the clarity and interpretation of the content. A panel of six experts/stakeholders was also asked how well each item reflected the concept of Navigational HL. The Content Validity Index for Items (I-CVI) and Scales (S-CVI) were applied to assess their content validity (Lynn 1986; Polit/Beck 2006). After revising the items, the final instrument was field tested in 33 personal interviews in the German pre-test, leading to slight adjustments based on the results and interviewers' feedback in the introduction part of the instrument.[6] The item evaluation took place in Germany. To ensure transferability to and practicability in other country contexts, the items were constantly translated back and forth between German and English throughout the entire process to obtain feedback from the other international experts participating in M-POHL. The methodological approach and the status of the instrument were also presented and discussed at two M-POHL meetings. The agreed English version of the final instrument was included in the HLS_{19} questionnaire and was integrated in the national translation processes (Chapter 2).

The final instrument (HLS_{19}-NAV) consists of 12 items mapping specific Navigational HL information tasks on the system (macro), organization (meso), and interaction (micro) levels of the healthcare system. Thus, Navigational HL is operationalized by asking for difficulties experienced in relation to tasks on accessing, understanding, appraising, and applying information for navigating the healthcare system. Like the HLS_{19}-Q12, the HLS_{19}-NAV uses the 4-point rating scale response categories "very difficult" – "difficult" – "easy" – "very easy" (for detailed procedure see Griese et al. 2020).

10.1.3 Objectives and research questions on Navigational HL

The overall objective was to develop and validate a new instrument for measuring Navigational HL and to provide, for the first time, data on Navigational HL covering a set of different countries participating in the HLS_{19} and to examine whether the new HL measure of Navigational HL adds value to the existing measure of General HL.

It is hypothesized that Navigational HL is related to the amount of complexity involved in how health care is provided in different healthcare systems and the associated requirements in information processing. Furthermore, it was assumed that Navigational HL is distributed differently in the population and, as was already shown in previous research on HL, is subject to a social gradient. In addition, the aim was to prove to what extent Navigational HL is linked to different health outcomes, with the focus being on health care utilization and general health status outcomes.

6
Germany was the first country that was able to conduct the national field test, so that its results on the Navigational HL measure could be included in the English version of the HLS19 questionnaire before other countries started their field testing.

The specific research questions are:

- To what extent does the newly developed instrument constitute a scale for measuring Navigational HL with acceptable psychometric properties?
- How is Navigational HL distributed over individual items and the score of its scale in the various countries participating in the HLS_{19}?
- How is Navigational HL distributed in different subpopulations and which population groups are particularly disadvantaged regarding Navigational HL?
- Is there a social gradient for Navigational HL and how strong are selected socio-economic and socio-demographic predictors of Navigational HL?
- How does Navigational HL correlate with the other HL measures in the HLS_{19}?
- Is there a significant association among Navigational HL, health care utilization, and general health outcomes?

10.1.4 Countries participating in Navigational HL

The topic of Navigational HL was included in the HLS_{19} as an optional package. The package was chosen and applied by eight countries: Austria (AT), Belgium (BE), Switzerland (CH), Czech Republic (CZ), Germany (DE), France (FR), Portugal (PT), and Slovenia (SI). A detailed overview of the countries using the optional package, including the type and period of data collection as well as the number of respondents can be found in Chapter 2 and Chapter 3 of this report.

10.2 Methods of analyses and results

To analyze and report on Navigational HL, the rated difficulties on the 12 HLS_{19}-NAV items, their Average Percentage Response Patterns (APRP) and measures of the HL-NAV (score) were used. The calculation of these indicators is based on the same procedure described for the HLS_{19}-Q12 (in Sections 4.2 & 4.4).

In the visualization of the perceived difficulties at item level, the response categories "very difficult" and "difficult" were combined for Figure 10.2. An overview of the results for all response categories can be found in Annex 10.1 (Table A 10.1 to Table A 10.12).

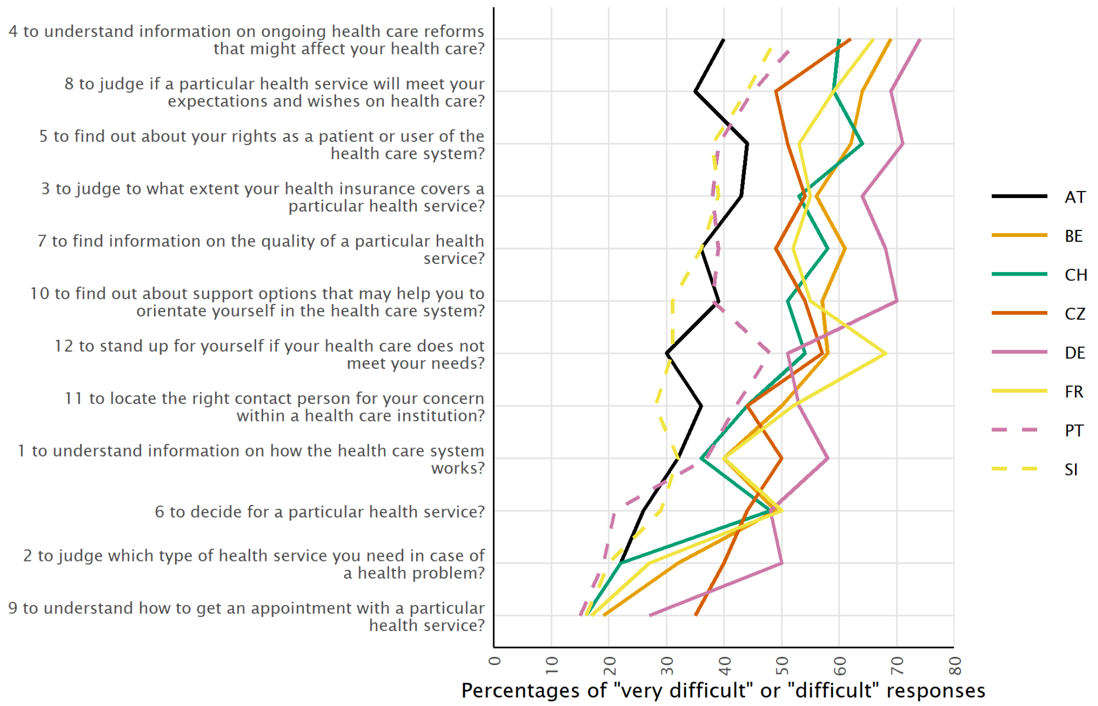
To calculate the APRP (for more detail, see Section 4.4), how often each respondent selected one of the four response categories was counted. Then, for each response category, it was calculated how often a category was selected on average before the mean values were scaled to the percentage of valid responses. The APRP indicate the distribution of average percentages for the four categories of all items in the HLS_{19}-NAV.

Following the HLS_{19} procedure for calculating General HL, Navigational HL is also based on a count of the dichotomized items by combining the categories “easy” and “very easy”. The resulting raw score was standardized to the range of 0 to 100 and so the score indicates the percentage of valid items that were answered with either “easy” or “very easy” by an individual respondent or, on average, by a group of respondents. Scores were only computed for respondents who had answered at least 80% of the 12 HLS_{19}-NAV items.

10.2.1 Distributions of individual HLS_{19}-NAV items by country

As Figure 10.2 demonstrates, there is some overlap in the ranking of the difficulty of Navigational HL tasks across countries, with some deviations.

Figure 10.2:
Percentages of respondents who responded with “very difficult” or “difficult” to the HLS_{19}-NAV items (ordered by the overall mean), for each country

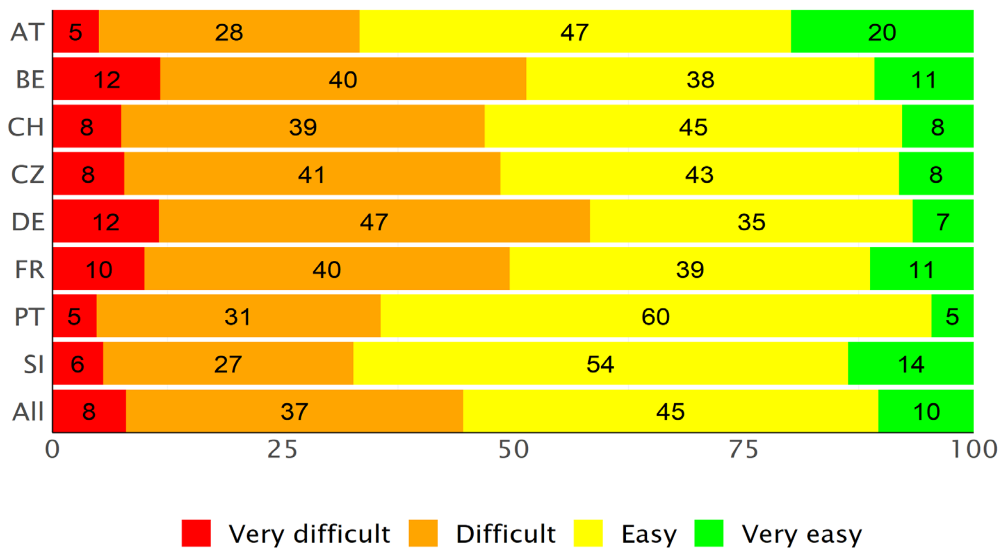


Source: HLS_{19} Consortium

The percentages of the combined “difficult” or “very difficult” answers to the 12 HLS_{19}-NAV items range between 19.5% and 56.6% (cf. Annex 10.1, Table A 10.13). In all participant countries, item HLS_{19}-NAV9 “to understand how to get an appointment with a particular health service” was assessed as being the easiest task (on average, with the countries weighted equally, only 19.5% answered “difficult” or “very difficult”). On the other hand, on average, 56.6% answered “difficult” or “very difficult” to item HLS_{19}-NAV4 “to understand information on ongoing health care reforms that might affect health care”, which thus was the most difficult task. Item HLS_{19}-NAV8 “to judge if a particular health service will meet the expectations and wishes on health care” was not much easier (52.0%). Likewise, item HLS$_{19}$-NAV5 “to find out about rights as a patient or user of the healthcare system” proved to be challenging (51.6%), as did item HLS$_{19}$-NAV3 “to judge to what extent the health insurance covers a particular health service” (49.2%). Furthermore, item HLS$_{19}$-NAV7 “to find information on the quality of a particular health service” was also rated “difficult” or “very difficult” by approximately half of all respondents (48.8%). In this regard it is striking that large parts of the population face problems in seeking help for such navigation requirements. Finally, 47.6% rated item HLS$_{19}$-NAV10 “to find out about support options that may help to orientate in the healthcare system” as being “difficult” or “very difficult”.

On average, 45% of the items were answered with "difficult" or "very "difficult" by all respondents (Figure 10.3). This percentage varied from 33% (AT, SI) to 59% (DE).

Figure 10.3:
Average Percentage Response Patterns (APRP) for the response categories “very difficult”-“difficult”-“easy”-“very easy” of the 12 HLS$_{19}$-NAV items, for each country and the mean of all countries (equally weighted)



Source: HLS$_{19}$ Consortium

10.2.2 Psychometric validity analyses

The newly developed HLS$_{19}$-NAV was validated using both classical and modern test theory.

To test for unidimensionality in Confirmatory Factor Analysis (CFA), the 12 items were set to *load on a single factor* using the lavaan package (Roussel 2012) for R (R Core Team 2020b). For details on the procedure, see Subsection 4.7.2 in this report. To estimate the internal consistency of the HLS$_{19}$-NAV, the Cronbach alpha coefficient was computed for each country (Subsection 4.7.1). To increase the validity of the scale, the two aspects of navigating on a systemic level and organizational level (Griese et al. 2020) were measured.[7] The two-factor model CFA indicates very slightly improved model fit indices for some countries (Annex 10.2, Table A 10.14). The high latent correlation between the two factors (r=0.84–0.96) indicated poor discriminant validity and, hence, suggested a one-factor structure. When fitting the data against the unidimensional polytomous partial credit Rasch model (Masters 1982; Rasch 1960) by using the RUMM2030plus software (Andrich/Sheridan 2019), the available dependent t-test procedure revealed that the two aspects introduced some multidimensionality into the scale. However, it was decided to treat the Navigational HL scale as unidimensional.

The results show (Table 10.1) that it is reasonable to include all items in a common index, even though there are some limitations regarding the evaluation of the overall model. For three countries (BE, CH, and PT), the Root Mean Square Error of Approximation (RMSEA) was > 0.06. Nevertheless, RMSEA < 0.08 can be interpreted as acceptable (Browne/Cudeck 1993). Similar assumptions can be made for the Standardized Root Mean Square Residual (SRMR), where values of < 0.8 indicate an acceptable model fit. With a minimum of 0.97, the other fit indices indicate at least an acceptable fit across all countries. The reliability values of the HLS_{19}-NAV can be rated as good (Table 10.3).

7 When testing for a multi-factor structure with an identical number of items in each scale, items HLS_{19}-NAV12 and HLS_{19}-NAV9 were excluded from analyses since they revealed limitations in the Rasch analyses for some countries: *System*: HLS_{19}-NAV1, 2, 3, 4, 5; *Organization*: HLS_{19}-NAV6, 7, 8, 10, 11.

Table 10.1:
Fit indices for the HLS_{19}-NAV single-factor CFA, for each country and the mean for all countries (equally weighted)

	AT	BE	CH	CZ	DE	FR	PT	SI	Mean
Standardized Root Mean Square Residual	0.05	0.06	0.07	0.03	0.07	0.05	0.06	0.05	0.06
Root Mean Square Error of Approximation	0.05	0.07	0.07	0.02	0.06	0.06	0.07	0.05	0.05
Root Mean Square Error of Approximation (CI lower bound)	0.05	0.06	0.06	0.01	0.06	0.05	0.06	0.05	0.06
Root Mean Square Error of Approximation (CI upper bound)	0.05	0.07	0.07	0.03	0.07	0.06	0.08	0.06	0.06
Root Mean Square Error of Approximation (p value)	0.48	0.00	0.00	1.00	0.00	0.01	0.00	0.06	0.19
Comparative Fit Index	0.99	0.99	0.99	1.00	0.98	1.00	1.00	0.99	0.99
Tucker-Lewis Index	0.99	0.99	0.98	1.00	0.97	0.99	0.99	0.99	0.99
Goodness of Fit Index	0.99	0.99	0.99	1.00	0.98	1.00	0.99	0.99	0.99
Adjusted Goodness of Fit Index	0.99	0.98	0.98	1.00	0.97	0.99	0.99	0.99	0.99

Source: HLS_{19} Consortium

Standardized parameter estimates are shown in Table 10.2. Loadings are close to or above 0.70 for most items, meaning the theorized factor explained most of the items well (Knekta et al. 2019). The loadings are highest between the factor and item HLS_{19}-NAV10 “to find out about support options that may help you to orientate yourself in the healthcare system” (mean: 0.86) and the lowest loadings between the factor and item HLS_{19}-NAV9 “to understand how to get an appointment with a particular health service” (mean: 0.68).

Table 10.2:
Standardized Parameter Estimates, for each country and the mean for all countries (equally weighted)

	AT	BE	CH	CZ	DE	FR	PT	SI	Mean
HLS_{19}-NAV1	0.74	0.80	0.74	0.78	0.73	0.79	0.85	0.80	0.78
HLS_{19}-NAV2	0.76	0.82	0.77	0.81	0.70	0.72	0.83	0.84	0.78
HLS_{19}-NAV3	0.72	0.75	0.73	0.76	0.61	0.84	0.80	0.84	0.76
HLS_{19}-NAV4	0.78	0.87	0.82	0.80	0.81	0.90	0.93	0.85	0.84
HLS_{19}-NAV5	0.85	0.86	0.87	0.84	0.80	0.85	0.87	0.86	0.85
HLS_{19}-NAV6	0.76	0.79	0.79	0.76	0.58	0.86	0.86	0.80	0.78
HLS_{19}-NAV7	0.81	0.88	0.83	0.77	0.70	0.89	0.93	0.87	0.84
HLS_{19}-NAV8	0.83	0.90	0.85	0.82	0.65	0.93	0.94	0.85	0.85
HLS_{19}-NAV9	0.58	0.61	0.62	0.82	0.65	0.57	0.82	0.77	0.68
HLS_{19}-NAV10	0.84	0.84	0.83	0.85	0.83	0.89	0.89	0.87	0.86
HLS_{19}-NAV11	0.77	0.79	0.75	0.79	0.65	0.85	0.89	0.79	0.78
HLS_{19}-NAV12	0.71	0.77	0.78	0.72	0.61	0.91	0.88	0.71	0.76

Source: HLS_{19} Consortium

Rasch analyses were administered to provide information on the overall data-model fit, targeting, reliability, individual item data-model fit, the ordering of response categories, response dependency, and the presence of differential item functioning (DIF).

Testing data against the unidimensional polytomous Rasch Partial Credit Model (PCM) (Masters 1982; Rasch 1960) for country-wise samples with 20 persons per threshold, good overall data-model fit for the HLS_{19}-NAV is observed in Austria ($\chi2$: n=720, $p > 0.05$). In Switzerland, the Czech Republic, and Germany, analyses display sufficient overall data-model fit ($\chi2$: n=720, $p > 0.01$). Reducing the sample size to n=360 or ten persons per threshold resulted in data collected in Belgium, Portugal, and Slovenia displaying sufficient/good overall data-model fit, but not France. For a well-targeted scale, the mean person location should be around zero, indicating that the measure is neither too easy nor too hard (Tennant/Conaghan 2007). The mean person location ranged between -0.31(DE PAPI) and 0.96 (SI CAWI). The scale was well-targeted for the following populations: Belgium (CAWI mean=-0.07), the Czech Republic (CAWI mean=-0.15), France (CAWI mean=0.11), Germany (PAPI mean=-0.31), Portugal (CATI mean=0.21), and Switzerland (CAWI mean=0.04). In Austria (CATI mean=0.91) and Slovenia (CAWI mean=0.96), targeting could have been somewhat better. Regarding the data-model fit at the item level, Infit (MNSQ) indicated poor fit and under-discrimination for item HLS_{19}-NAV9 in the Belgian (MNSQ=1.39) and French data (MNSQ=1.54) as well as for item HLS_{19}-NAV12 in the Czech (MNSQ=1.35) and Slovenian (MNSQ=1.44) data (MNSQ >1.3 and significant $\chi2$) (Yan/Mok 2012). As DIF analyses are sensitive to sample size, only significant DIFs at a Bonferroni-adjusted 5% and amended sample size of n=720 are reported. Item HLS_{19}-NAV3 displayed DIF for employment status in data from Belgium and Switzerland as well as for age in data from Switzerland and France. Furthermore, item HLS_{19}-NAV4 displayed DIF for age and item HLS_{19}-NAV6 displayed DIF for difficulty with paying bills in Portugal. Item HLS_{19}-NAV7 displayed DIF for gender and age in the Czech Republic, for age in France, and for education level and difficulties with paying bills in Switzerland. For item HLS_{19}-

NAV8, the French data indicated DIF for age. Item HLS_{19}-NAV9 displayed DIF for age and employment status in Austria. In Belgium, DIF was observed for item HLS_{19}-NAV12 regarding paying bills. It is striking that with the sample size of n=720, no items displayed DIF in the German and Slovenian data. Response dependency was observed between items HLS_{19}-NAV7 and HLS_{19}-NAV8 in the Belgian (r=0.37), Portuguese (r=0.43), and Swiss (r=0.38) data. No signs of unordered response categories were found, indicating that the 4-point response scale worked well.

In line with the reported Cronbach's alpha (Tennant/Conaghan 2007), the Person Separation Index (PSI) indicated high reliability.

Table 10.3:
Cronbach's alpha and the Person Separation Index (PSI) for HLS_{19}-NAV, for each country and the mean of all countries (equally weighted)

	AT	BE	CH	CZ	DE	FR	PT	SI	Mean
Alpha	0.87	0.89	0.88	0.90	0.83	0.91	0.92	0.90	0.89
PSI	0.90	0.92	0.91	0.92	0.88	0.93	0.88	0.92	0.91

Source: HLS_{19} Consortium

In all countries, the correlation between the Navigational HL score (HL-NAV) and the General HL (GEN-HL) score was positive and at, on average, r=0.56 (varying from r=0.41 (BE) to r=0.63 (FR)) also of considerable size (Table 10.4).

Regarding the other specific HL measures used in the HLS_{19}, a positive correlation was shown for the HL-NAV and the long and short forms of the "HL relating to communication with physicians in health care services measure" (HL-COM) in each country (r=0.47/r=0.43 on average, ranging from 0.49 (AT) to 0.36 (BE)). The same applies to HL-NAV and Digital HL (HL-DIGI) (r=0.55 on average, ranging from 0.67 (FR) to 0.36 (BE)). A positive correlation was also observed between HL-NAV and Vaccination HL (HL-VAC) with, on average, r=0.40, ranging from r=0.49 (SI) to r=0.26 (BE).

Therefore, it can be argued that the HL-NAV overlaps with the other HL measures used in the HLS_{19}, showing that it belongs to this family of HL measures, but that its use in the HLS_{19} is independent enough from these to make a specific contribution to measuring HL.

Table 10.4:
Pearson correlation between HL-NAV and other HL scores used in the HLS19, for each country and the mean for all countries (equally weighted)

HL-NAV and	AT	BE	CH	CZ	DE	FR	PT	SI	Mean
GEN-HL	0.56	0.41	0.56	0.55	0.6	0.63	0.53	0.61	0.56
HL-COM-Q11	0.49	–	–	–	0.48	–	–	0.45	0.47
HL-COM-Q6	0.46	0.36	–	0.45	0.45	0.44	–	0.44	0.43
HL-DIGI	0.57	0.36	0.52	0.57	0.59	0.67	0.54	–	0.55
HL-VAC	0.38	0.26	–	0.47	0.38	–	0.42	0.49	0.4

Source: HLS19 Consortium

10.2.3 Distribution of the Navigational HL scores by country

Like the GEN-HL score, the HL-NAV score was also defined to range from 0-100, where 0 indicates the lowest and 100 the highest possible level of Navigational HL. The mean score (Table 10.5) indicates the percentage of valid items that were answered with either "easy" or "very easy" on average by the respondents in individual countries or by selected subpopulation groups.

On average the mean score is 55.3, varying considerably from 41.6 (DE) to 67.4 (SI). The standard deviation (SD) on average is 31.8 (varying from 28.2 (DE) to 34.1 (FR)). The distribution of the HL-NAV does not indicate normal distribution but rather differing distribution patterns across countries and a strong ceiling effect for all countries, apart from DE, where the distribution is rather right-skewed (Annex 10.4, Figure A 10.1).

Table 10.5:
Means, standard deviations, quartiles, for HL-NAV, for each country and the mean for all countries (equally weighted)

HL-NAV	AT	BE	CH	CZ	DE	FR	PT	SI	Mean
Mean	66.8	48.6	52.9	50.7	41.6	50.4	64.2	67.4	55.3
SD	30.1	32.8	31.5	33.8	28.2	34.1	32.4	31.7	31.8
Median	75.0	41.7	50.0	50.0	41.7	41.7	66.7	75.0	
25th percentile	41.7	16.7	25.0	20.0	16.7	16.7	64.2	41.7	
75th percentile	100.0	75.0	83.3	83.3	58.3	83.3	100.0	100.0	

Source: HLS19 Consortium

10.2.4 Identification of specific vulnerable/disadvantaged subpopulations

Like for General HL, it is also of interest to explore what disadvantaged or vulnerable subpopulations have lower Navigational HL than the average population. The same eight subgroups were investigated as for General HL (Table 10.6). The strongest deviations from general population means were found for bad or very bad self-perceived health (on average -11.6, varying from -4.4 (CZ) to -20.4 (PT)), followed by considerable or severe financial deprivation (on average -9.9, varying from -1.5 (BE) to -14.4 (PT)), level in society/social status (less than or equal to 4) (on average -9.0, varying from -1.9 (AT) to -15.9 (PT)), education (ISCED 0,1) (on average -5.6, varying from 7.1 (CZ) to -14.2 (SI)), and limited by health problems (on average -5.4, varying from -2.8 (CZ) to -13.4 (PT)), while the average deviations were lowest for age (76 or older) yet inconsistent (on average -1.7, varying from +6.3 (CZ) to -14.5 (SI)), long-term illnesses/health problems (one or more) (on average -3.4, varying from -0.4 (BE) to -8.6 (PT)), and utilization of GPs/family doctors (6 or more contacts) (on average -3.4, varying from -1.0 (CZ) to -6.5 (DE)).

Table 10.6:
Deviation of Navigational HL mean scores for potentially vulnerable subpopulations relative to the total mean score of the country, for each country and the mean for all countries (equally weighted)

	AT	BE	CH	CZ	DE	FR	PT	SI	All
HL-NAV country mean	66.8	48.6	52.9	50.7	41.6	50.4	64.2	67.4	55.3
Aged 76 or older	4	–	4.2	6.3	-8.7	–	–	-14.5	-1.7
Education at ISCED levels 0 or 1	–	–	-4.5	7.1	–	–	-10.6	-14.2	-5.6
Level in society less than or equal to 4	-1.9	-11.7	-7.5	-6.5	-9.5	-7.7	-15.9	-11.6	-9
Considerable or severe financial deprivation	-12	-1.5	-8.2	-13.9	-10.3	-8.7	-14.4	-10.5	-9.9
Bad or very bad self-perceived health	-6.3	-10.6	-10.2	-4.4	-14.8	-6.3	-20.4	-19.6	-11.6
One or more long-term illnesses or health problems	-2.9	-0.4	-2.9	-0.6	-3.1	-3.3	-8.6	-5.5	-3.4
Limited by health problems	-6.2	-3.5	-4.6	-2.8	-3.9	-1.1	-13.4	-7.7	-5.4
6 or more contacts with a GP/family doctor	-3	-2.2	-3.9	-1	-6.5	-3.3	–	-4.2	-3.4

– Cells with less than 30 respondents were not reported, as was the case in some countries for old age, low education, and contacts with a GP/family doctor, were not reported.

Source: HLS_{19} Consortium

10.2.5 Determinants of Navigational HL

Like in the HLS_{19} generally, a social gradient and core social determinants were also investigated for Navigational HL. As hypothesized, core socio-demographic and socio-economic determinants like gender, age, education, level in society, financial deprivation, and, additionally, migration status and training in a health profession were investigated. Migration background was not included in the regression analyses due to extremely low Spearman correlations with Navigational HL across all countries. Training in a health profession, which is not a common social predictor of HL, was just included as a Spearman correlation in Table 10.7.

In all countries, the correlations between Navigational HL and the hypothesized determinants are rather weak, being highest on average for financial deprivation (ρ=−0.19, varying from ρ=−0.05 (BE) to ρ=−0.35 (PT)), level in society (ρ=0.15; varying from ρ=−0.01 (AT) to ρ=0.28 (PT)), and for no training in a health profession (ρ=−0.09, varying from ρ=0.03 (AT) to ρ=−0.15 (DE). The correlations with gender, education, age, and migration status are rather low, in contrast, partly due to very different and inconsistent forms of associations of these potential determinants with Navigational HL (see Figures A 10.2 to A 10.7 in Annex 10.7).

Table 10.7:
Spearman correlations between Navigational HL and selected determinants, for each country and for all countries (equally weighted)

	AT	BE	CH	CZ	DE	FR	PT	SI	All
Gender female	−0.03	−0.05	−0.04	−0.01	−0.03	−0.08	−0.02	−0.01	−0.04
Age in years	−0.07	0	0.04	0	−0.09	−0.1	−0.13	−0.13	−0.06
Education	0	0.03	−0.03	−0.09	0.2	0	0.11	0.15	−0.02
Level in society	−0.01	0.22	0.17	0.16	0.25	0.17	0.28	0.23	0.15
Financial deprivation	−0.18	−0.05	−0.21	−0.27	−0.22	−0.16	−0.35	−0.3	−0.19
Migration background	0.07	0.05	0.02	0	0	0	0.01	0.02	0.03
No training in a health profession	0.03	−0.08	−0.07	−0.13	−0.15	−0.11	−0.1	−0.14	−0.09

Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).
Migration background: 0=none, 1=one parent born abroad, 2=both parents born abroad, 3=born abroad.

Source: HLS_{19} Consortium

A multivariable linear regression model with the five socio-demographic and socio-economic variables explained on average 6% of the variance (varying from 4% (AT) to 13% (PT)) (Table 10.8). The strongest predictor is financial deprivation (β=−0.15, varying from −0.01 (BE) to −0.25 (CZ)), followed by level in society (β=0.14, varying from 0 (AT) to 0.22 (BE)), age (β=−0.08, varying from

0.01 (CH) to −0.13 (FR)), education (β=−0.11, varying from 0.10 (DE) to −0.14 (CZ)), and gender female (β=−0.02, varying inconsistently from +0.02 (CZ) to −0.07 (FR)). Thus, it can be concluded that there is a social gradient for Navigational HL, differing considerably across countries.

Table 10.8:
Multivariable linear regression models of Navigational HL by five core social determinants (standardized coefficients (β) and R^2), for each country and for all countries (equally weighted)

	AT	BE	CH	CZ	DE	FR	PT	SI	All
Gender female	−0.02	−0.05	−0.04	0.02	−0.01	**−0.07**	0	0.01	**−0.02**
Age in years	**−0.07**	−0.02	0.01	−0.02	**−0.09**	**−0.13**	**−0.10**	**−0.09**	**−0.08**
Education	**−0.06**	−0.03	**−0.13**	**−0.14**	**0.10**	**−0.10**	**−0.08**	−0.02	**−0.11**
Level in society	0	**0.22**	**0.14**	**0.12**	**0.15**	**0.17**	**0.18**	**0.12**	**0.14**
Financial deprivation	**−0.18**	−0.01	**−0.17**	**−0.25**	**−0.11**	**−0.09**	**−0.23**	**−0.23**	**−0.15**
R^2	0.04	0.05	0.07	0.1	0.09	0.06	0.13	0.11	0.06
Valid count	2587	988	1983	1523	1845	2003	1012	3160	
Total count	2967	1000	2502	1599	2143	2003	1247	3360	

Coefficients with p-values lower than 0.01 in bold.
Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of −0.005 to +0.005.
Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

Source: HLS_{19} Consortium

With the inclusion of General HL in the model, the explained variance, on average, rises considerably to 35% (varying from 19% (BE) to 43% (FR)) (Table 10-9). Now General HL is by far the strongest predictor of Navigational HL (β=0.53, varying from 0.38 (BE) to 0.62 (FR)), which could be expected due to the considerable correlation of the two measures. By adding General HL, the other predictors are reduced, but level in society (β=0.09) and financial deprivation (β=−0.07) are still somewhat stronger on the overall level than education (β=−0.06), age (β=−0.05), and being female (β=−0.04).

Table 10.9:
Multivariable linear regression models of Navigational HL by five core social determinants and GEN-HL (standardized coefficients (β) and R^2), for each country and for all countries (equally weighted)

	AT	BE	CH	CZ	DE	FR	PT	SI	All
GEN-HL	**0.54**	**0.38**	**0.52**	**0.51**	**0.56**	**0.62**	**0.48**	**0.56**	**0.53**
Gender female	**−0.06**	−0.06	−0.05	−0.02	−0.05	**−0.09**	0.02	−0.01	**−0.04**
Age in years	−0.03	−0.03	0.01	**−0.07**	−0.03	**−0.13**	−0.05	−0.02	**−0.05**
Education	−0.04	−0.01	**−0.12**	**−0.07**	0.03	**−0.07**	**−0.13**	−0.04	**−0.06**
Level in society	0	**0.15**	**0.09**	**0.06**	**0.1**	**0.08**	**0.14**	**0.07**	**0.09**
Financial deprivation	**−0.07**	−0.03	**−0.1**	**−0.14**	−0.02	0	**−0.13**	**−0.12**	**−0.07**
R^2	0.32	0.19	0.32	0.34	0.39	0.43	0.33	0.39	0.35
Valid count	2587	988	1983	1523	1845	2003	1012	3160	
Total count	2967	1000	2502	1599	2143	2003	1247	3360	

Coefficients with p-values lower than 0.01 in bold.
Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of −0.005 to +0.005.
GEN-HL score: from 0=minimal HL to 100=maximal HL.
Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

Source: HLS_{19} Consortium

10.2.6 Consequences of Navigational HL

No specific potential consequences for Navigational HL were included in the HLS_{19}. Therefore, to test the relevance of Navigational HL for health-related outcomes, a few indicators were selected for consequences which had mostly already been included in the HLS-EU and which had partly been changed and added to as part of the HLS_{19}. This was done by investigating Spearman correlations (Table 10.10 and Table 10.13) and bi-variate associations (Annex 10.6, Figures A 10.8 to A 10.16). Multiple linear regression models were used to test whether there is an independent, direct effect of Navigational HL on selected indicators for health care utilization (Table 10.11 and Table 10.12) and indicators for health status (Table 10.14 to Table 10.15) when potentially confounding factors are controlled for.

Health care utilization

Spearman correlations show a slight negative relationship between Navigational HL and different indicators for health care utilization, i.e., with higher Navigational HL, somewhat less use is made of health care services (Table 10.10). The correlation is strongest for GPs/family doctors (ρ=−0.12, varying from ρ=0 (CZ) to ρ=−0.14 (DE)) and for medical or surgical specialists (ρ=−0.08, varying from ρ=−0.01 (BE) to ρ=−0.10 (DE)), while the correlations are weaker for inpatient hospital services (ρ=−0.01, varying from ρ=−0.01 (CH) to ρ=0.09 (FR)), day patient hospital services (ρ=−

0.01, varying from ρ=0 (CH, DE) to ρ=−0.05 (AT, CH)), and emergency services (ρ=−0.02, varying from ρ=−0.01 (CH) to ρ=−0.05 (AT, DE, PT, and SI)).

Table 10.10:
Spearman correlations (ρ) of Navigational HL with five indicators for health care utilization, for each country and for all countries (equally weighted)

HL-NAV and...	AT	BE	CH	CZ	DE	FR	PT	SI	All
Emergency services	−0.05	−0.04	−0.01	0.03	−0.05	0.01	−0.05	−0.05	−0.02
GPs/family doctors	−0.12	−0.04	−0.04	0	−0.14	−0.08	−0.04	−0.08	−0.12
Medical or surgical specialists	−0.07	−0.01	−0.06	−0.03	−0.1	−0.07	−0.06	−0.02	−0.08
Hospital as an inpatient	0.01	0.01	−0.01	0.04	−0.06	0.09	0.04	−0.03	−0.01
Hospital as a day patient	−0.03	−0.02	0	−0.02	0	−0.01	0.06	−0.03	−0.01

Utilization of emergency services: number of contacts in the last 24 months, from 0 to 6 or more contacts.
Utilization of GPs/family doctors: number of contacts in the last 12 months, from 0 to 6 or more contacts.
Utilization of medical or surgical specialists: number of contacts in the last 12 months, from 0 to 6 or more contacts.
Utilization of inpatient hospital services: number of contacts in the last 12 months, from 0 to 6 or more contacts.
Utilization of day patient hospital services: number of contacts in the last 12 months, from 0 to 6 or more contacts.

Source: HLS_{19} Consortium

Multivariable linear regression models were calculated for the utilization of all five health services as dependent variables and the Navigational HL score and five socio-demographic and socio-economic determinants as independent variables. Only the regression models for the use of GPs/family doctors and medical or surgical specialists are reported here since the models for the other three indicators of health care utilization just explain 1% to 2% of the variance in total. The multivariable regression models for the use of GPs/family doctors explain 7% of the variance (varying from 5% (FR) to 15% (DE)) (Table 10.11) and for medical or surgical specialists 5% (varying from 4% (FR) to 12% (DE)) (Table 10.12).

The values of β coefficients for Navigational HL in the models are the second strongest, but with a slight β=−0.09 for GPs/family doctors (varying from β=0.03 (CZ) to −0.09 (DE), significant only for two countries), and the fourth strongest with β=−0.06 for medical or surgical specialists (varying from 0.01 (BE, SI) to −0.07 (DE), significant only for one country). Thus, when confounding variables are controlled for, Navigational HL is only relevant for two indicators of health services utilization and is only significant for two and one country respectively.

Table 10.11:
Multivariable linear regression models of utilization of GPs/family doctors by Navigational HL and five social determinants (standardized coefficients (β) and R^2), for each country and for all countries (equally weighted)

	AT	BE	CH	CZ	DE	FR	PT	SI	All
HL-NAV	**−0.07**	−0.02	−0.04	0.03	**−0.09**	−0.05	0.02	−0.03	**−0.09**
Gender female	**0.1**	**0.08**	0.03	0	**0.07**	**0.08**	**0.16**	**0.08**	**0.07**
Age in years	**0.23**	**0.16**	**0.18**	**0.17**	**0.31**	**0.18**	**0.16**	**0.17**	**0.21**
Education	−0.01	**−0.18**	−0.03	**−0.09**	−0.02	0	−0.03	0	**0.04**
Level in society	0.03	−0.06	**−0.08**	−0.02	−0.04	−0.01	0	0.01	0
Financial deprivation	**0.09**	−0.01	**0.08**	**0.12**	**0.09**	**0.09**	0.08	**0.11**	**0.06**
R^2	0.1	0.09	0.06	0.06	0.15	0.05	0.07	0.06	0.07
Valid count	2543	981	1982	1503	1792	2003	1012	3151	
Total count	2967	1000	2502	1599	2143	2003	1247	3360	

Coefficients with p-values lower than 0.01 in bold.
Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of −0.005 to +0.005.
Utilization of GPs/family doctors: number of contacts in the last 12 months, from 0 to 6 or more contacts.
NAV-HL score: from 0=minimal HL to 100=maximal HL.
Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

Source: HLS_{19} Consortium

Table 10.12:
Multivariable linear regression models of utilization of medical or surgical specialists by Navigational HL and five social determinants (standardized coefficients (β) and R^2), for each country and for all countries (equally weighted)

	AT	BE	CH	CZ	DE	FR	PT	SI	All
HL-NAV	-0.04	0.01	-0.04	-0.01	**-0.07**	-0.03	-0.05	0.01	**-0.06**
Gender female	**0.21**	**0.14**	**0.08**	**0.13**	**0.09**	**0.13**	**0.14**	**0.06**	**0.12**
Age in years	**0.11**	**0.16**	**0.11**	**0.17**	**0.28**	**0.12**	**0.1**	**0.16**	**0.15**
Education	**0.1**	-0.04	**0.11**	0.06	0.06	**0.1**	**0.18**	**0.08**	**0.07**
Level in society	0	**-0.09**	-0.06	-0.03	-0.04	0.04	0.06	-0.01	0
Financial deprivation	**0.05**	0.06	**0.13**	0.06	**0.09**	**0.1**	0.06	**0.07**	**0.03**
R^2	0.07	0.06	0.05	0.04	0.12	0.05	0.05	0.04	0.05
Valid count	2554	971	1980	1503	1815	2003	1012	3146	
Total count	2967	1000	2502	1599	2143	2003	1247	3360	

Coefficients with p-values lower than 0.01 in bold.
Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of -0.005 to +0.005.
HL-NAV score: from 0=minimal HL to 100=maximal HL.
Utilization of medical or surgical specialists: number of contacts in the last 12 months, from 0 to 6 or more contacts.
Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

Source: HLS_{19} Consortium

Indicators for health status

In comparison with the indicators for health care utilization, the correlations of Navigational HL with indicators for health status are considerably stronger, being strongest on average for self-perceived health (ρ=-0.19, varying from ρ=-0.13 (CZ, PT) to ρ=-0.24 (SI)), followed by limited in activities due to health problems (ρ=0.16, varying from ρ=0.08 (CZ) to ρ=0.21 (PT)), and long-term illnesses/health problems (ρ=-0.11, varying from ρ=-0.01 (BE) to ρ=-0.19 (PT)). On average, associations are rather linear and continuous, but somewhat less consistent for individual countries (Annex 10, Figures A 10.14 to A 10.16).

Table 10.13:
Spearman correlations (ρ) of Navigational HL with three indicators for health status, for each country and for all countries (equally weighted)

HL-NAV and...	AT	BE	CH	CZ	DE	FR	PT	SI	ALL
Health in general	−0.19	−0.16	−0.14	−0.13	−0.21	−0.15	−0.13	−0.24	−0.19
Long-term illnesses/ health problems	−0.08	−0.01	−0.07	−0.02	−0.11	−0.08	−0.19	−0.15	−0.11
Limited in activities due to health problems	0.11	0.14	0.12	0.08	0.15	0.01	0.21	0.19	0.16

Self-perceived health: from very good (1) to very bad (5).

Long-term illness: 3 categories: (1) none, (2) one, (3) more than one, except for SI where 2 categories were used (1) none, (2) one or more.

Limitations due to health problems: from severely limited (1) to not limited at all (3).

Source: HLS_{19} Consortium

The linear multivariable regression models testing the potential effects of Navigational HL on selected indicators for health status explain on average much more variance in comparison with the models for health care utilization. On average, the highest R^2 is observed for self-perceived health (the model explains 18% of the variance (varying from 12% (BE) to 32% (PT)) (Table 10.14), followed by long-term illnesses/health problems with 12 % (variation from 8 % (CH) to 17 % (PT)) (Table 10-15), and limited in activities due long-term illnesses/health problems with 9 % (variation from 4 % (FR) to 18 % (DE)) (10.16).

The β values for Navigational HL are also comparably higher for self-perceived health (β=−0.13, varying from −0.01 (PT) to −0.13 (AT, DE), significant for seven out of the eight countries), for limitations due to health problems with an overall β of 0.11 (varying from −0.04 (FR) to 0.10 (BE, PT), significant for five out of the eight countries), and less distinct for long-term illnesses/health problems with an overall β of −0.07 (varying from +0.01 (BE, CZ) to −0,06 (SI), significant for only two countries). Thus, Navigational HL has slight but significant potential effects on at least two indicators of health status.

Table 10.14:
Multivariable linear regression models of self-perceived health (standardized coefficients (β) and R^2) by Navigational HL and five core social determinants, for each country and for all countries (equally weighted)

	AT	BE	CH	CZ	DE	FR	PT	SI	All
HL-NAV	**-0.13**	**-0.1**	**-0.1**	**-0.07**	**-0.13**	**-0.06**	-0.01	**-0.12**	**-0.13**
Gender female	-0.02	0.04	-0.05	-0.03	-0.03	-0.02	**0.09**	0.02	0
Age in years	**0.24**	0.07	**0.22**	**0.35**	**0.41**	**0.23**	**0.33**	**0.37**	**0.27**
Education	**-0.06**	-0.08	-0.04	**-0.11**	-0.03	0.02	**-0.13**	**-0.08**	**-0.04**
Level in society	**-0.11**	**-0.28**	**-0.18**	**-0.13**	**-0.08**	**-0.23**	**-0.11**	**-0.07**	**-0.16**
Financial deprivation	**0.16**	-0.04	**0.16**	**0.15**	**0.13**	**0.12**	**0.18**	**0.19**	**0.13**
R^2	0.15	0.12	0.15	0.25	0.26	0.15	0.32	0.3	0.18
Valid count	2584	988	1982	1523	1843	2003	1012	3157	
Total count	2967	1000	2502	1599	2143	2003	1247	3360	

Coefficients with p-values lower than 0.01 in bold.
Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of -0.005 to +0.005.
HL-NAV score: from 0=minimal HL to 100=maximal HL.
Self-perceived health: from very good (1) to very bad (5).
Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

Source: HLS_{19} Consortium

Table 10.15:
Multivariable linear regression models of long-term illnesses/health problems by Navigational HL and five core social determinants (standardized coefficients (β) and R^2), for each country and for all countries (equally weighted).

	AT	BE	CH	CZ	DE	FR	PT	SI	All
HL-NAV	−0.04	0.01	−0.04	0.01	−0.05	−0.04	**−0.1**	**−0.06**	**−0.07**
Gender female	0.03	0.06	−0.01	0.02	0.04	−0.01	0.04	**0.05**	**0.03**
Age in years	**0.24**	**0.23**	**0.26**	**0.27**	**0.41**	**0.29**	**0.31**	**0.3**	**0.29**
Education	**−0.08**	−0.08	0.01	−0.02	0.03	0.01	0	−0.04	**−0.02**
Level in society	**−0.07**	**−0.1**	**−0.08**	−0.05	−0.06	−0.02	−0.01	−0.01	**−0.04**
Financial deprivation	**0.13**	0.07	0.05	**0.11**	**0.08**	**0.11**	**0.16**	**0.11**	**0.09**
R^2	0.12	0.09	0.08	0.1	0.2	0.1	0.17	0.15	0.12
Valid count	2579	988	1980	1523	1819	2003	1008	3156	
Total count	2967	1000	2502	1599	2143	2003	1247	3360	

Coefficients with p-values lower than 0.01 in bold.
Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of -0.005 to +0.005.
Long-term illness: 3 categories: (1) none, (2) one, (3) more than one, except for SI, where 2 categories were used (1) none, (2) one or more.
HL-NAV score: from 0=minimal HL to 100=maximal HL.
Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

Source: HLS_{19} Consortium

Table 10.16:
Multivariable linear regression models of limited in activities due health problems (by Navigational HL and five core social determinants standardized coefficients (β) and R^2), for each country and for all countries (equally weighted)

	AT	BE	CH	CZ	DE	FR	PT	SI	All
HL-NAV	**0.07**	0.1	**0.09**	0.03	**0.08**	−0.04	**0.1**	**0.09**	**0.11**
Gender female	0	**−0.12**	−0.04	−0.03	−0.03	0.03	**−0.13**	**−0.04**	**−0.04**
Age in years	**−0.13**	0.03	**−0.15**	**−0.19**	**−0.35**	**−0.11**	**−0.17**	**−0.26**	**−0.2**
Education	**0.09**	**0.13**	−0.01	**0.1**	0	−0.03	0.05	**0.05**	**0.03**
Level in society	**0.13**	**0.14**	**0.14**	0.04	0.07	0.03	0.03	**0.06**	**0.05**
Financial deprivation	**−0.16**	0.1	**−0.11**	**−0.15**	**−0.13**	**−0.16**	**−0.2**	**−0.13**	**−0.12**
R^2	0.1	0.09	0.08	0.09	0.18	0.04	0.16	0.16	0.09
Valid count	1996	472	1977	1520	1724	2003	806	3157	
Total count	2967	1000	2502	1599	2143	2003	1247	3360	

Coefficients with p-values lower than 0.01 in bold.
Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of −0.005 to +0.005.
Limitations due to health problems: from severely limited (1) to not limited at all (3).
HL-NAV score: from 0=minimal HL to 100=maximal HL.
Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

Source: HLS_{19} Consortium

With the inclusion of General HL in the regression models (Annex 10.8, Table A 10.16 to Table A 10.18), the explained variance for all countries rises only marginally from 18% to 20% (varying from 13% (BE) to 33% (PT)) for general health and from 9% to 11% (varying from 5% (FR) to 19% (PT)) for limited in activities due to health problems. No changes are observed for long-term illnesses/health problems, with explained variance still at 12% (varying from 8% (CH) to 19% (PT)).

The values of β for Navigational HL are drastically reduced, showing that General HL is a much stronger predictor than Navigational HL for the health status indicators under consideration. Now, higher Navigational HL is linked to better self-perceived health with β increasing to −0.08 but significant for only two countries, long-term illnesses/health problems but not significant for any country, and limitations in activities due to health problems with β=−0.11 but significant for only one country. Thus, Navigational HL only has small extra direct effects on indicators of health status, in addition to the potential effects of General HL.

10.3 Discussion and Conclusion

The HLS_{19} introduced a new measurement instrument for Navigational HL based on an explicit model and definition of Navigational HL (Griese et al. 2020) which is related to the model and definition of the HLS-EU Consortium (Sørensen et al. 2012) and its somewhat revised operationalization in the HLS_{19}. The instrument was applied in eight countries participating in the HLS_{19}, with a total of over 16,000 respondents. For these countries, the distributions of individual items and the Navigational HL scores as well as the social gradients, determinants, and selected consequences of Navigational HL were analyzed and demonstrated for the first time.

The newly developed HLS_{19}-NAV instrument was extensively investigated psychometrically. The results of analyses used (Cronbach's alpha, CFA, and Rasch) indicate that the instrument mostly proved to be satisfactory across the countries included in the survey. This demonstrates that the HLS_{19}-NAV is a suitable instrument to measure Navigational HL in different countries, languages, and using different survey methods. Nevertheless, there is also room for some improvements regarding the under-discrimination of individual items and DIF in some countries.

The Navigational HL topic was included as an optional package in the HLS_{19} because many healthcare systems – as the literature suggests – are extremely complex and suffer from a high level of disintegration, which in turn places great demands on users in terms of orientation, navigation, and use that cannot be managed easily. This also applies to dealing with navigation-related information. The findings confirm this and show that Navigational HL is low in adult resident populations and that dealing with the healthcare system and with information essential to navigating it is difficult for a large proportion of potential users. This also becomes evident when the findings are compared to those on General HL (and other specific health literacies in the HLS_{19}), showing Navigational HL to be lower than the other measured health literacies in the HLS_{19}.

Regarding the different information tasks, the results of the survey show that information *especially on the systemic level* is experienced as being (very) difficult in many countries and that basic knowledge and skills are therefore required to utilize information about the healthcare system, its organization, and how it functions. Processing information on (political) changes, reforms within the healthcare system, and patient rights, the latter being particularly important to enable more autonomy and co-production, is also seen as being (very) difficult. In addition, there seems to be a lack of sufficient support to overcome such challenges. All of this should be considered when developing interventions to facilitate navigation of the healthcare system and improve the information needed to do so.

This also applies to results on the *organizational level* where many experience it as being (very) difficult to find information on quality-related issues. Orientation and navigation within healthcare facilities are also experienced as being difficult, a finding that underscores the importance of organizational HL (Pelikan 2019; Farmanova et al. 2018; Brach et al. 2012) and demonstrates the need to make the healthcare system concerned more user-friendly and easily navigable, including the immediate (literal and interactive) environments in which health care is sought (Rudd/Anderson 2006; Rudd 2004).

On the interactive level[8] almost half of all respondents (46.5%) found it (very) difficult "to stand up for yourself if your health care does not meet your needs". The answers varied greatly among countries, but the results indicate that changes in the patient's role on the interactive level towards more collaboration, informed decision making, and negotiation of health care based on one's own

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[8] Only one item is included here, see Subsection 10.1.2.

preferences still pose difficulties that cannot be met adequately by patients and healthcare professionals. As a result, communication with healthcare professionals is often one-sided. Thus, replacing traditional (paternalistic) patterns of interaction with new ones remains a challenge across countries, as was also demonstrated by the survey results on HL relating to communication with physicians in health care services which show that respondents considered it particularly important to be given more time to process information (HLS_{19}-COM4) in a simplified language that they could understand easily (HLS_{19}-COM7) (see Chapter 11).

In addition, the findings reveal country-specific characteristics that are presumably based on the structure of the healthcare system concerned. Therefore, improving Navigational HL also means to including and further investigating country or context-specific challenges when developing interventions to strengthen Navigational HL.

Furthermore, the results show that Navigational HL is distributed differently among various subpopulation groups. People with limited financial resources and low level in society/poor social status have lower Navigational HL. Thus, a social gradient for Navigational HL has been demonstrated that is more pronounced in some countries than in others. Less pronounced but also worth mentioning is the fact that in some countries, an age gradient was shown that should be specifically considered in the production of navigation-related information. These results on Navigational HL, like those on General HL, underscore the importance of identifying disadvantaged groups when developing interventions. Healthcare systems must become easier to use, especially for these disadvantaged groups, through simple, transparent, clear, and user-friendly structures and service models as well as through more targeted, group-specific information.

The HLS_{19} also shows that General HL can be interpreted as the strongest predictor of Navigational HL, which suggests an overlap in basic competencies that are significant for both General HL and Navigational HL. This is an important result since investments in General HL could also be beneficial for Navigational HL and vice versa. Similar assumptions can be made for other health literacies that have been examined, especially Communicative HL with physicians (Chapter 11) and Digital HL (Chapter 12). On the one hand, the positive relationship between Navigational HL and other HL measures was expected, since the measurement instruments were developed against the background of a common understanding, definition, and operationalization of HL and the HLS_{19}-NAV is therefore part of a 'family' of new HL measurement tools; on the other hand, this points to common interfaces between the concepts. Good communication skills in patients but also the general circumstances created by physicians (e.g., enough time, opportunities for queries) obviously lead to a better understanding of information relevant for navigating healthcare systems. Furthermore, much of the navigation-related information is available for users online. Such information may be used for initial orientation in the healthcare system or when searching for a suitable health service, access to it, and its modalities of utilization but also to clarify open questions on navigational issues after consultations with health professionals. A hypothesis derived from the results is that this is more successful when Digital HL is also high. Examining the relationship between Navigational HL, Communicative HL with physicians, and Digital HL should be a topic of further research.

Another important finding is that, like for General HL (Pelikan et al. 2018; Sørensen et al. 2015), low Navigational HL is associated with implications for health status. The inclusion of General HL in the regression models significantly reduced this effect, but some effect persists regarding self-perceived health. Surprisingly, Navigational HL is less clearly associated with the use of health care. On the basis of previous trends in HL research (Berens et al. 2018; Ownby et al. 2014; Berkman et al. 2011), it was assumed that higher Navigational HL would be associated with lower health care utilization. This was only partly true in a multivariable linear regression model for two indicators of primary care utilization. In the future, however, more specific potential outcome measures should be investigated for Navigational HL (e.g., indicators of misuse of the healthcare system, problems with access or navigation).

Limitations

A comparative analysis of Navigational HL among participating countries is only possible to a limited extent due to differences in the survey methods used. For example, in contrast to the other countries, data collection in Germany took place before the Covid-19 pandemic; indications that Navigational HL in Germany tended to improve slightly during the Covid-19 pandemic are provided in a complementary survey conducted as part of the national HL survey (Schaeffer et al. 2021).

The interactive level of Navigational HL is underrepresented in this Chapter because Communication with physicians in health services HL (part of the micro level of Navigational HL) was measured separately in the HLS_{19}. To enable the instrument to be used and tested as a stand-alone instrument in the future, it would be desirable to elaborate on this level in an extended version.

Conclusions

The HLS_{19}-NAV was developed, tested, and used for the first time in the HLS_{19} in eight different countries. This added valuable information about dealing with information in the specific context of navigating healthcare systems, but it also needs refining and testing. Regarding future measurements of Navigational HL in an international context, it will be important to carefully review the quality of translations into the national language(s) concerned to ensure comprehensibility for the various population groups. In addition, it would be desirable to pay equal attention to the interactive or communicative level (micro level) in the future, which was underrepresented in this study. A starting point here could be the items of the HLS_{19}-COM. Further expansion and research are required to test more specific potential consequences of Navigational HL.

Overall, the results confirm that navigating healthcare systems represents an "unfamiliar context" for many respondents (Nutbeam 2009: 304), namely one that requires special knowledge and special HL. In future, it will therefore be important to strengthen Navigational HL and General HL at all levels of healthcare systems. The results provide a number of suggestions on how this can be done (see Chapter 15 for recommendations). Implementation is of major importance since Navigational HL is very low for considerable proportions of adult resident populations in many countries.

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11 Communicative Health Literacy with physicians in health care services

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11.1 Background and development of instrument

11.1.1 Overview of the relevance, existing research, and measures of Communicative Health Literacy in health care services

Communicative HL might be essential to participate actively in health communication with health professionals, to obtain and understand information, and to use that information to manage health. Health care services play a critical role in developing HL in the population. People in need of health care are more open to health issues and therefore are in a “teachable moment” for health education (Lawson/Flocke 2009). Currently there is a focus on health services being developed as health literate organizations (Brach et al. 2012) to strengthen the HL of the population as well as to promote patient-centered care, health promotion, and prevention (Palumbo 2021).

Typically, there are two ways to provide health-related information within the health services: 1) health information provided through diverse media (apps, brochures, flyers, info-sheets, posters, websites, videos, magazines, TV) and 2) (inter)personal communication between a health professional and a user of health care.

Communication in health care in the context of this optional package refers to physician[9]-patient communication within the healthcare system. This research focuses on face-to-face interactions in co-presence, although communication within health care services also includes telephone and video consultations. Communication is a core task for health professionals and patients when establishing diagnoses, deciding on and implementing treatments, organizing adequate health care, and maintaining good health.

People strongly rely on personal communication with health professionals (Chen et al. 2018). Thus, health care communication and patient participation in health care has been recognized as a decisive part of HL as well as a critical determinant of successful disease management and health outcomes (van der Heide et al. 2018; Amalraj et al. 2009; Paasche-Orlow 2007).

The quality of communication between patients and health professionals – especially physicians – is one of patients’ main concerns and the most important source of (dis-)satisfaction with health care (Stahl/Nadj-Kittler 2013; Langewitz et al. 2002). Good communication in health care has been shown to be associated with a wide range of improved health care outcomes and also contributes to the workplace satisfaction of health professionals (Sator et al. 2015; Street et al. 2009; Mead/Bower 2002). However, communication in almost all healthcare systems – as the findings of the HLS-EU study revealed (HLS-EU Consortium 2012) – needs improvement on all levels.

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[9] The term ‘doctor’ was used in the questionnaire to ensure plain language. As the term ‘physician’ is used more in formal discourse, this term is used in this chapter.

This focus on communication is becoming increasingly important due to changes in the patients' role, such as the demand for more patient involvement and shared decision making (Elwyn et al. 2016; Meijers et al. 2019) as well as for formal informed consent. Health professionals are not only required to communicate more comprehensively and in a patient-centered manner but must also pay more attention to the provision of information, patient empowerment, and shared decision making to enable patients to become co-producers of their own health care (Elwyn et al. 2020; Palumbo/Lars Tummers 2016).

Especially for people with limited (health) literacy, personal oral communication is usually the main source of information on their health and health care. However, patients with lower HL report on worse communication with health professionals than those with higher HL (Castro et al. 2007; Schillinger et al. 2004). Furthermore, patients with lower literacy have been shown to be less likely to ask health professionals questions (Katz et al. 2007). Thus, the good communication skills of health professionals could contribute to health equality.

Nutbeam (2000); Nutbeam (2008); Nutbeam, Don (2009) indicate the importance of interactive processes by defining Communicative/Interactive HL as one of three relevant domains of HL and linking it especially to the goal of greater autonomy and personal empowerment. Nutbeam (2000) defines Communicative/Interactive literacy as: "more advanced cognitive and literacy skills which, together with social skills, can be used to actively participate in everyday activities, to extract information and derive meaning from different forms of communication, and to apply new information to changing circumstances". Nutbeam (2008) highlights the importance of developing specific measurements for these "oral literacy and social skills". This part of the study aims to develop such a measurement instrument focusing on communication with physicians in the specific context of health care to be used in a general population-based survey.

Expanding Nutbeam's understanding, the following definition of Communicative/Interactive HL in health care is used in this study: Communicative HL refers to patients' communicative and social skills that enable them to actively engage in face-to-face encounters with healthcare professionals, to give and seek information, derive meaning from it, and apply this information in decision making and in co-producing their health care. In the HLS_{19}, attention was focused on physician-patient communications in this regard.

To date research on measuring Communicative HL in health care has been quite limited (Nouri/Rudd 2015). Roter et al. (2007) developed an Oral Literacy Demand Framework for genetic counseling dialogues including three language elements: (1) use of technical terms, (2) general complexity of language, and (3) structural characteristics of the dialogue. Building on Nutbeam's concepts, Ishikawa et al. (2008) focused on interactive HL as "Communicative HL", highlighting the importance of personal communication in HL. Rubin et al. (2011) used "the term 'interactive health literacy' to denote patient/consumer's propensity to exert individual agency in actively participating and seeking information in encounters with healthcare providers and information sources." On this basis, Rubin et al. (2011) developed the Measure of Interactive Health Literacy (MIHL) to code the interactive skills of a consumer in telephone conversations. O'Hara et al. (2018) published the concept of the "Conversational Health Literacy Assessment Tool (CHAT)" to provide a short actionable survey tool for the clinical context to assess patients' ability to interact with health professionals, but the ten questions developed for CHAT mainly focus on general health information-seeking behavior and health promotion activities. Only one question focuses on interactive behavior.

Conversely, research on measuring the quality of communication processes between healthcare providers (especially physicians) and patients in general is well established and has a longstanding tradition mainly in communication science, linguistics, and medical psychology. The main conceptual background for measuring the quality of communication in health care is the rise of "patient-centered medicine" (Balint 1969) over the last 50 years, with patient-centered communication being one of its most important dimensions (Zill et al. 2015). Very diverse measurement approaches have been developed (Ball et al. 2018; Brouwers et al. 2017; Zill et al. 2014; Eveleigh et al. 2012; Epstein et al. 2005), that can be roughly categorized by:

» *Observed aspects of the communication:* linguistic and communicative behavior, self-reported psychological and emotional experiences, perceptions and attitudes of patients and/or doctors;
» *Observer perspectives*: the physician's perspective, the patient's perspective, and third-party observers (raters, teachers/supervisors, co-workers) (Burt et al. 2018);
» *Methodology of data generation and analysis*: e.g., participant observation, recording interactions, rating systems and checklists, interviews with doctors and/or patients, surveys for patients and doctors;
» *Purpose, context, setting, and population of measurement:* basic research, assessment and feedback in training, workplace-based assessments, quality management, intercultural communication, etc.

11.1.2 Arguments for providing a new measure and the procedure for developing the measure

Only a few studies have tried to integrate HL instruments from these diverse research traditions into the quality of communication in health care. One example is a French study (Ousseine et al. 2019), in which general measures of HL and numeracy were combined with a standard measurement tool for Shared Decision Making (SDM). Ishikawa et al. (2008) included five questions about Communicative HL in their instrument. However, the tasks included in these questions were not specific to personal interaction with health professionals, such as physicians. The questions included in Chinn/McCarthy (2013) do relate to this setting but this instrument lacks aspects of active participation in communication, such as expressing one's own preferences and being involved in decision making. Hence, to our knowledge there is no comprehensive instrument that captures all of the main tasks described by Nutbeam (2000), takes into account the important aspects of communication in health care derived from the diverse research traditions mentioned above, and considers the basic competencies of information processing according to the conceptual model of HL used by the HLS-EU Consortium (Sørensen et al. 2012) that is also the basic measurement approach of the HLS_{19}.

As a consequence, a conceptual framework was identified that integrates the most important aspects of communication in health care derived from these diverse research traditions, namely the well-established "Calgary-Cambridge Guide to the Medical Interview" (C-CG) (Silverman et al. 2013). This framework has been developed over the last 25 years and integrates the results of different research traditions to serve as a guide to teaching health professionals patient-centered communication skills; it is also used as a framework for assessments (e.g. Iversen et al. 2020). The C-CG describes 56 single communicative practices of a health professional in six main phases of a routine interaction in health care. Within these six main phases, the communicative tasks of patients can be identified that need to be considered in the conceptual framework for Communicative HL (see Table 11.1). Relating to the definition of interactive HL (Nutbeam 2000), we also identified "participating actively" as an additional overarching task that is relevant in all other communicative tasks for patients (see Table 11.1).

Table 11.1:
Overview of the main communicative practices of health professionals in the Calgary-Cambridge Guide to the Medical Interview (C-CG) and the main communicative tasks of patients, which together constitute the Conceptual Framework for Communicative HL

C-CG main phases	Patients' communicative tasks	
1. Initiating the session	1. Opening the session and giving initial information	Participating actively
2. Gathering information	2. Giving full information	
3. Providing structure	3. Understanding and following the agenda	
4. Building relationship	4. Expressing one's own views/feelings and trusting the health professionals (e.g., physicians)	
5. Explanation and planning	5. Understanding and decision making (extracting information and deriving meaning)	
6. Closing the session	6. Final understanding, agreement (and application)	

Source: HLS_{19} Consortium

Based on this conceptual framework, steps to develop an instrument for measuring Communicative HL were taken by a working group of representatives from the HLS_{19} countries led by the first and second authors of this chapter. The detailed procedure for developing the instrument is shown in Figure 11.1. As a general approach, the aim was to identify at least one question/item per main communicative task to capture the most important challenges of HL in health care communication. These questions were selected in a multistage process. In a first step the conceptual framework developed for the existing HLS-Q47 instrument was applied (HLS-EU Consortium 2012). Six items on communication were already included in the HLS-Q47 (Q5, Q8, Q9, Q10, Q13, and Q16), but according to the C-CG, these items only measure aspects of two main phases of physician-patient interactions (explanation and planning; closing the session). In particular, key patient information tasks were not captured by the HLS-Q47, e.g., presenting their own concerns and preferences, asking questions.

Therefore, as a second step a targeted literature search was carried out to identify questionnaires and possible items on HL in the context of health care communication in English and German literature. In total, 20 very diverse instruments (Bieber et al. 2010; Burt et al. 2014; CAHPS 2017;

Campbell et al. 2007; Chinn/McCarthy 2013; Ernstmann et al. 2017; ESTAT 2017; Farin et al. 2013; Gibney/Moore 2018; HCAHPS 2019; Ishikawa et al. 2008; Makoul et al. 2007; Maly et al. 1998; Myerholtz et al. 2010; National Institutes of Health 2018; Osborne et al. 2007; Picker Institute Europe 2013; Smith et al. 2006; Sustersic et al. 2018; ten Klooster et al. 2012; van der Heide et al. 2015; Waldherr et al. 2019; Zegers et al. 2020) were included in addition to the HLS-Q47. These 20 instruments contained 183 items all together on health care communication. The conceptual framework (Table 11.1) was applied to map these 183 questions and select a preliminary set of 15 questions to measure Communicative HL. This set of items was discussed in several feedback loops with the Communicative HL working group of the HLS_{19} and the International Coordination Center. The understandability and importance of each item were also assessed in two focus groups involving potential survey participants in Austria (using the German version). Based on these discussions and the piloting phase, the HLS_{19}-COM-P instrument was developed to focus exclusively on physician-patient communication and can be used in a longer form (11 items) and a shorter form (6 items). Originally, the working group considered measuring Communicative HL in dialogue with health professionals in general. However, during pretesting, the general term "health professionals" was not well accepted by the participants. Because their experiences differ depending on the kind of health professional, the term was perceived to be too vague, which made it difficult to form an opinion and respond to the items. In addition, the status of different health professions varies widely across the participating countries but that of physicians is quite similar and comparable. Therefore, the group decided to focus on physician-patient communication.

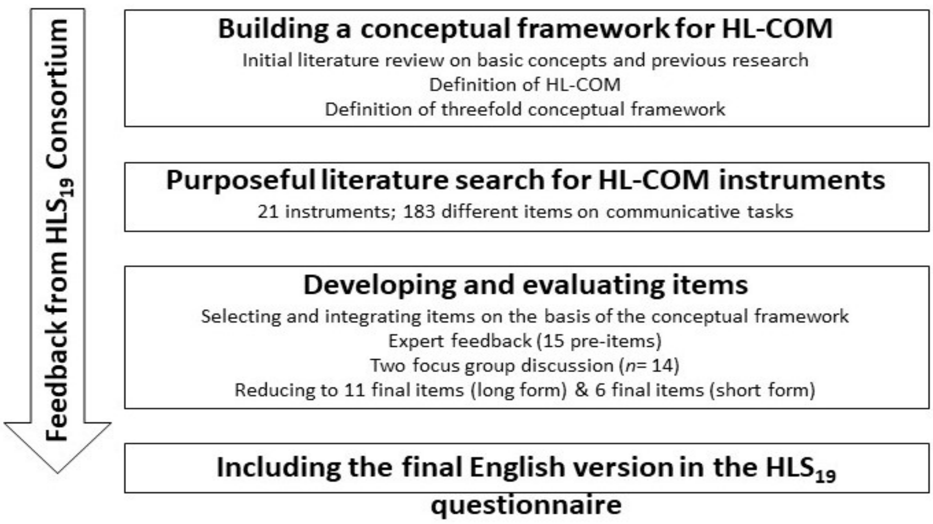
The HLS_{19}-COM-P instrument measures all six main communicative phases of physician-patient interactions according to the C-CG (Table 11.1) and can be used to analyze the dimensions of Interactive/Communicative literacy in accordance with Nutbeam (2000) and the basic competencies of information processing according to the conceptual model of HL developed by the HLS-EU Consortium (Sørensen et al. 2012).

Table 11.2:
Final list of items for the HLS19-COM-P (the short form Q6 is on a grey background)

Patients' communicative tasks	Proposed HLS19 items	
	On a scale from very easy to very difficult, how easy would you say it is for you ...	
1. Opening the session and giving initial information	Item 1	... to describe to your doctor your reasons for coming to the consultation?
2. Giving full information	Item 2	... to make your doctor listen to you without being interrupted?
	Item 3	... to explain your health concerns to your doctor?
3. Understanding and following the agenda	Item 4	... to get enough time in the consultation with your doctor?
4. Expressing one's own views and trusting	Item 5	... to express your personal views and preferences to your doctor?
5. Understanding and decision making	Item 6	... to get the information you need from your doctor?
	Item 7	... to understand the words used by your doctor?
	Item 8	... to ask your doctor questions in the consultation?
	Item 9	... to be involved in decisions about your health in dialogue with your doctor?
6. Final understanding and agreement	Item 10	... to recall the information you get from your doctor?
	Item 11	... to use the information from your doctor to take care of your health?

Source: HLS19 Consortium

Figure 11.1:
Steps in the development of the instrument to measure HL-COM



Source: HLS19 Consortium

To ensure transferability to the health systems context of other countries, the items were translated multiple times back and forth between German and English to obtain feedback from the other international experts participating in M-POHL. The methodological approach and the items were also presented and discussed at two M-POHL meetings in March 2019 (Dublin) and August 2019 (Berlin). The agreed English version of the final instrument was included in the HLS_{19} questionnaire and made available to the participating countries. Responsibility for the country-specific translation and integration in national pre-tests was assigned to the principal investigator of each country using the HLS_{19}-COM-P instruments.

11.1.3 Objectives and research questions on Communicative HL

The underlying general hypotheses are that (1) better Communicative HL is a precondition for successful communication between patients and physicians and, at the same time, (2) successful communication in health care promotes Communicative HL itself and is also partly a precondition for Navigational HL.

The seven research questions for the optional package “Communicative HL with physicians in health care” in the HLS_{19} are:

1. To what extent do the newly developed HLS_{19}-COM-P items constitute an instrument with acceptable psychometric properties?
2. How is Communicative HL in health care distributed in various countries and different subpopulations within each country?
3. What are experienced as the most difficult tasks in Communicative HL?
4. How is Communicative HL in health care related to General HL?
5. How is Communicative HL in health care related to Navigational HL?
6. What are the determinants of Communicative HL in health care, based on background variables measured in the HLS_{19}?
7. What are the consequences of Communicative HL in health care, independent of General HL, based on relevant correlates measured in the HLS_{19}?

11.1.4 Countries using the HLS_{19}-COM-P

The HLS_{19}-COM-P instrument was successfully applied by nine countries: Austria (AT), Belgium (BE), Bulgaria (BG), Czech Republic (CZ), Germany (DE), Denmark (DK), France (FR), Hungary (HU), and Slovenia (SI). An overview of the procedures in the countries using the optional package is shown in Table 11.3.

Table 11.3:
Countries applying the optional package on Communicative HL

Country	Short (SF)/Long form (LF)	Type of data collection	Period of data collection	Number of respondents
AT	LF	CATI	16.03.2020–26.05.2020	2,967
BE	SF	CAWI	30.01.2020–28.02.2020 and 01.10.2020–26.10.2020	1,000
BG	SF	CAPI, CAWI	10.–24.11.2020	865
CZ	SF	CATI, CAWI	10.–24.11.2020	1,599
DE	LF	PAPI	13.12.2019–27.01.2020	2,143
DK	SF	CAWI	11.12.2020–05.02.2021	3,602
FR	SF	CAWI	27.05.2020–05.06.2020 and 08.01.2021–18.01.2021	2,003
HU	SF	CATI	02.12.2020–20.12.2020	1,205
SI	LF	CAPI, paper-and-pencil, CAWI	09.03.2020–15.03.2020 and 09.06.2020–10.08.2020	3,360

Source: HLS_{19} Consortium

11.2 Methods and results

To analyze data and report on Communicative HL in the context of physician-patient interactions, different indicators were constructed: the perceived difficulties of the individual items of the HLS_{19}-COM-P-Q11 and the HLS_{19}-COM-P-Q6, the Average Percentage Response Patterns (APRP) for HLS_{19}-COM-P-Q11 and the HLS_{19}-COM-P-Q6 (for more detail on the methods, see Section 4.4), and the Communicative HL (mean) scores for the long and short version. In the visualization of the perceived difficulties at item level, the response categories "very difficult" and "difficult" were combined.

Following the HLS_{19} procedure for calculating General HL (described in Section 4.2), the Communicative HL scores are based on a count of the dichotomized HLS_{19}-COM-P items by combining the categories “easy” and “very easy”. The resulting scores were standardized to the range of 0 to 100 and so the scores indicate the percentage of valid items that were answered with either “easy” or “very easy” by an individual respondent or, on average, by a group of respondents. Scores were only computed for respondents who had answered at least 80% of the HLS_{19}-COM-P items.

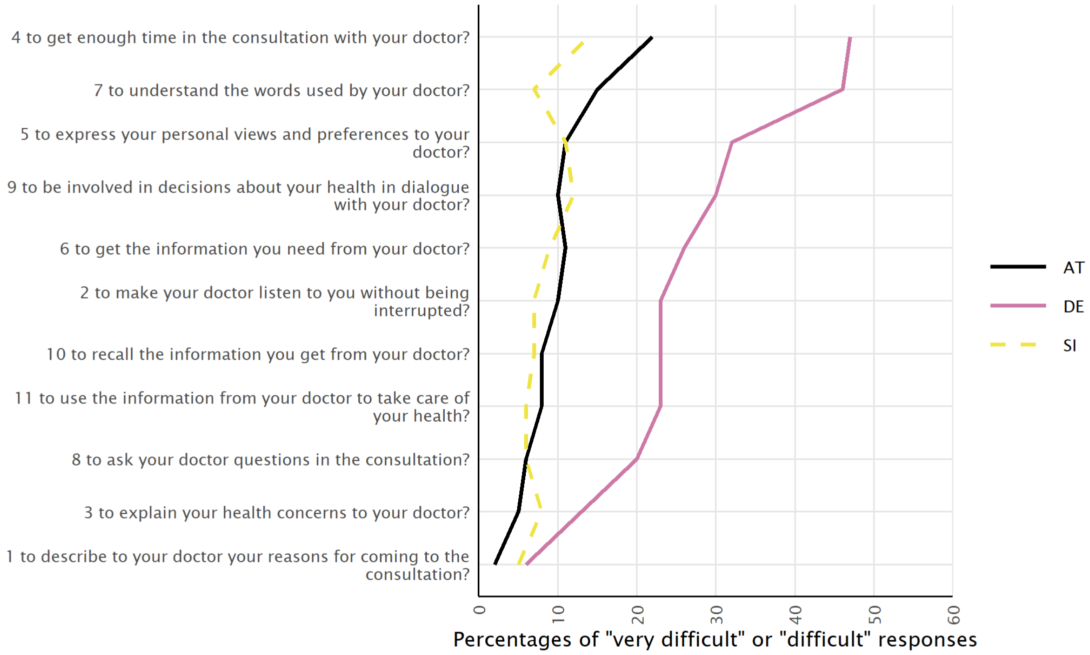
Vulnerable/disadvantaged subpopulations were identified by comparing the mean score of groups (e.g., specific age groups or people with a low education) with the overall mean of the population. The procedures for the regression analyses performed for this chapter are described in detail in Section 4.6.

The newly developed HLS_{19}-COM-P-Q11 and the short version, HLS_{19}-COM-P-Q6, were evaluated using both classical and modern test theory. Confirmatory factor analysis (CFA) was performed using the lavaan package (Rosseel 2012) for R (R Core Team 2020b). For both versions of the instrument, a single factor model consisting of dichotomized items was assessed. To assess the internal consistency (reliability) of the HLS_{19}-COM-P, Cronbach’s alpha is reported for each country. Conducting Rasch modeling, data were tested against the unidimensional polytomous partial credit Rasch model (PCM) (Masters 1982; Rasch 1960). Analyses at the overall level included those for data-model fit, dimensionality, and targeting. At the item level, the analyses included evaluation of item fit, response dependency, ordering of the response categories, and the presence of differential item functioning (DIF). In addition, information on the reliability index, i.e., the Person Separation Index (PSI), is provided. Rasch analysis was performed using the software RUMM2030Plus (Andrich/Sheridan 2019). In addition, ConQuest5 (Adams et al. 2020) was used to investigate infit. For the detailed procedure for the psychometric assessment of the instruments, see Subsection 4.7.3.

11.2.1 Distributions of individual items by country

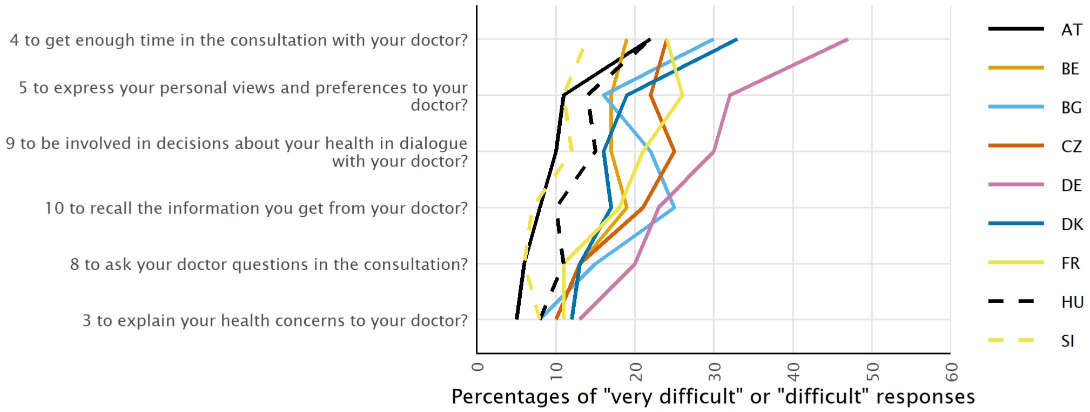
Figure 11.2 and Figure 11.3 show the percentages for the perceived difficulty (“very difficult” and “difficult” responses) of each item on the HLS_{19}-COM-P-Q11 and HLS_{19}-COM-P-Q6 by country. The proportion perceiving difficulties for the total sample ranges from 4.4% to 25.3% for the HLS_{19}-COM-P-Q11 items and from 9.2% to 26.2% for the HLS_{19}-COM-P-Q6 items (for total and country values, see Table A 11.12 in Annex 11.1). An overview of the results for all response categories can be found in Annex 11.1 (Table A 11.1 to Table A 10.11). The items perceived to be the least difficult using HLS_{19}-COM-P-Q11 and HLS_{19}-COM-P-Q6 for the total sample are “to describe to your doctor your reasons for coming to the consultation” (4.4%) and “to explain your health concerns to your doctor” (9.2%). The most difficult item is “to get enough time in the consultation with your doctor”, where a quarter of the respondents perceived difficulties, whether in the HLS_{19}-COM-P-Q11 or HLS_{19}-COM-P-Q6. This item had the highest difficulty in seven countries (AT, BE, BG, DE, DK, HU, and SI) and was rated among the most difficult items in the other two countries (CZ, FR) as well.

Figure 11.2:
Percentages of respondents who responded with “very difficult” or “difficult” to the HLS19-COM-P-Q11 items (ordered by the overall mean), for each country



Source: HLS19 Consortium

Figure 11.3:
Percentages of respondents who responded with “very difficult” or “difficult” to the HLS19-COM-P-Q6 items (ordered by the overall mean), for each country



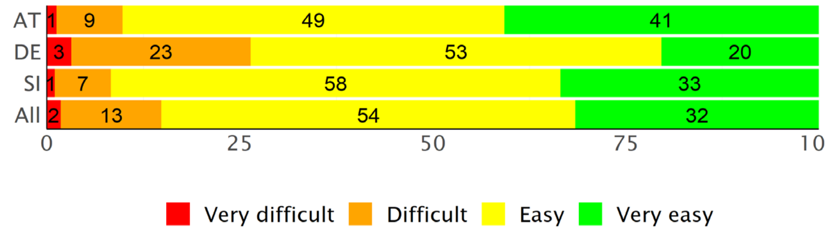
Source: HLS19 Consortium

In CZ, where Communicative HL was measured using the HLS19-COM-P-Q6, item 9 “to be involved in decisions about your health in dialogue with your doctor” was rated as being most difficult

(24.6% perceived this item as “difficult” or “very difficult”), whereas item 5 “to express your personal views and preferences to your doctor” was perceived as most difficult in FR (25.9% perceived this item as “difficult” or “very difficult” measured using the HLS_{19}-COM-P-Q6). Almost half (46.4%) of the respondents from DE reported difficulties understanding the words used by physicians. As the “difficulty order” varies somewhat between countries, the HLS_{19}-COM instruments do not measure Communicative HL invariantly across countries. Due to different cultural backgrounds and different healthcare systems, respondents from different countries may have interpreted the content of the items differently (items displaying differential item functioning, DIF, across countries). Hence, the scores obtained in different countries should be compared with caution. Different data collection modes were also used in the different countries, which may also have affected the response patterns.

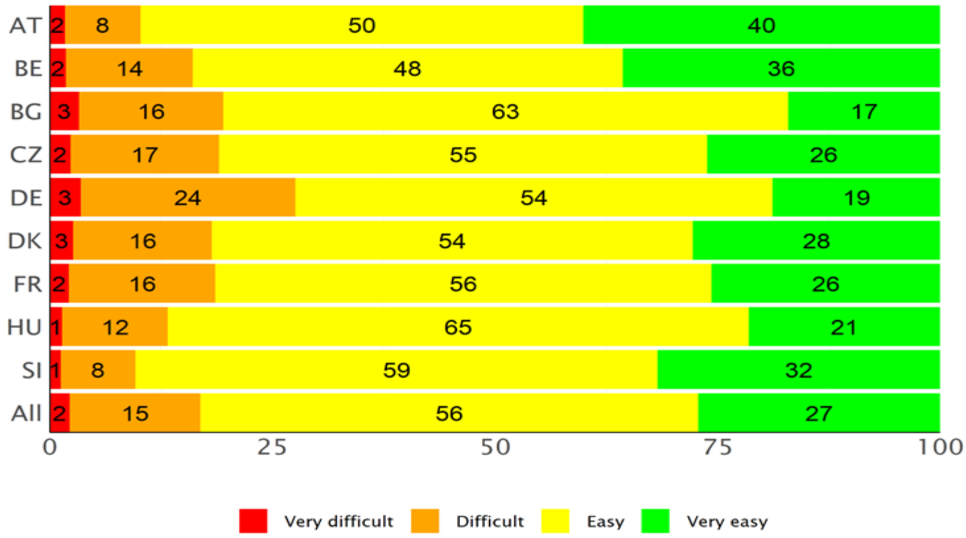
Figure 11.4 and Figure 11.5 show the APRP for the HLS_{19}-COM-P-Q11 and HLS_{19}-COM-P-Q6 respectively. These figures confirm the findings at item level, namely that on average the HLS_{19}-COM-P items were relatively easy, with about 10% (AT and SI) to just below 20% (BG, CZ, DK, and FR) reporting, on average, difficulties with the Communicative HL tasks under consideration. In Germany, a quarter of the respondents reported such difficulties. It is noteworthy that the proportion of people reporting very difficult communication with their physician is very low (2%) in the whole sample and in all countries.

Figure 11.4:
Average Percentage Response Patterns (APRP) for the item set of the HLS_{19}-COM-P-Q11, for each country and the mean of all countries (equally weighted)



Source: HLS_{19} Consortium

Figure 11.5:
Average Percentage Response Patterns (APRP) for the item set of the HLS$_{19}$-COM-P-Q6, for each country and the mean for all countries (equally weighted)



Source: HLS$_{19}$ Consortium

11.2.2 Psychometric validity analyses

The psychometric properties of the HLS_{19}-COM-P-Q11 and the short version, HLS_{19}-COM-P-Q6, were assessed using CFA and Rasch analysis.

11.2.2.1 Confirmatory factor analysis

Both the HLS_{19}-COM-P-Q11 and the HLS_{19}-COM-P-Q6 obtained acceptable goodness-of-fit indices (Table 11.4).

The standardized parameter estimates indicate that the theorized factor explained most of the items well as the loadings are close to or above 0.7 for most items (Table 11.5). For the HLS_{19}-COM-P-Q11, items HL-COM3 ("to explain your health concerns to your doctor") and HL-COM6 ("to get the information you need from your doctor") had the highest loading (mean: 0.83), whereas HL-COM7 ("to understand the words used by your doctor") and HL-COM10 ("to recall the information you get from your doctor") had the lowest (mean: 0.67). For the HLS_{19}-COM-P-Q6 items, HL-COM5 ("to express your personal views and preferences to your doctor") had the highest loading (mean: 0.90), whereas item HL-COM10 again had the lowest (mean: 0.64).

Table 11.4:
Fit indices for the one-factor model (CFA) of the HLS_{19}-COM-P-Q11 (left) and the HLS_{19}-COM-P-Q6 (right), for each country

	Q11			Q6									Ref.
Fit indices for the CFA	**AT**	**DE**	**SI**	**AT**	**BE**	**BG**	**CZ**	**DE**	**DK**	**FR**	**HU**	**SI**	
SRMR	0.06	0.07	0.06	0.03	0.04	0.05	0.03	0.03	0.02	0.03	0.05	0.02	≤ 0.08
RMSEA	0.02	0.05	0.04	0.00	0.02	0.04	0.01	0.03	0.01	0.02	0.02	0.01	≤ 0.06
RMSEA; CI, lower bound	0.02	0.05	0.03	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	
RMSEA; CI, upper bound	0.03	0.06	0.04	0.02	0.05	0.06	0.03	0.04	0.02	0.04	0.05	0.03	
RMSEA; p-value	1.00	0.16	1.00	1.00	0.98	0.75	1.00	1.00	1.00	1.00	0.98	1.00	
CFI	0.99	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	≥ 0.95
TLI	0.99	0.98	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	≥ 0.95
GFI	1.00	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	≥ 0.95
AGFI	0.99	0.98	0.99	1.00	1.00	0.99	1.00	0.99	1.00	1.00	1.00	1.00	≥ 0.9

AGFI=Adjusted Goodness of Fit Index; CFI=Comparative Fit Index; CI=Confidence interval; GFI=Goodness of Fit Index; Ref=reference values good fit; RMSEA=Root Mean Square Error of Approximation; SRMR=Standardized Root Mean Square Residual; TLI=Tucker-Lewis Index

Source: HLS_{19} Consortium

Table 11.5:
Standardized parameter estimates for the HLS_{19}-COM-P-Q11 (left) and the HLS_{19}-COM-P-Q6 (right), for each country and the mean for all countries (equally weighted)

	Q11				Q6									
Item no.	**AT**	**DE**	**SI**	**Mean**	**AT**	**BE**	**BG**	**CZ**	**DE**	**DK**	**FR**	**HU**	**SI**	**Mean**
HL-COM1	0.77	0.79	0.82	0.79										
HL-COM2	0.80	0.79	0.88	0.82										
HL-COM3	0.78	0.78	0.93	0.83	0.74	0.69	0.81	0.81	0.72	0.84	0.79	0.90	0.92	0.80
HL-COM4	0.79	0.75	0.80	0.78	0.77	0.78	0.75	0.75	0.73	0.71	0.77	0.79	0.77	0.76
HL-COM5	0.82	0.77	0.88	0.82	0.86	0.91	0.92	0.91	0.81	0.94	0.88	0.92	0.91	0.90
HL-COM6	0.80	0.81	0.88	0.83										
HL-COM7	0.57	0.68	0.75	0.67										
HL-COM8	0.78	0.82	0.85	0.82	0.79	0.91	0.90	0.90	0.83	0.90	0.87	0.89	0.86	0.87
HL-COM9	0.80	0.76	0.87	0.81	0.80	0.86	0.89	0.89	0.77	0.86	0.89	0.85	0.88	0.85
HL-COM10	0.58	0.66	0.76	0.67	0.52	0.71	0.74	0.61	0.60	0.60	0.71	0.57	0.68	0.64
HL-COM11	0.59	0.71	0.76	0.69										

Source: HLS_{19} Consortium

11.2.2.2 Rasch analysis

Testing data against the unidimensional polytomous Rasch Partial Credit Model (PCM), the overall data-model fit for the HLS_{19}-COM-P-Q6 was sufficient for data collected in Austria (CATI) and Germany (PAPI). The overall data-model fit for the HLS_{19}-COM-P-Q6 was also acceptable for Belgium (CAWI), Bulgaria (CAPI and CAWI), the Czech Republic (CAWI), Denmark (CAWI), Hungary (CATI), and Slovenia (CAPI and CAWI) when the analysis was based on a reduced sample (n=180; 6 items x 3 thresholds x 10 respondents). The HLS_{19}-COM-P-Q11 also displayed acceptable overall data-model fit in all countries when the sample size was reduced to n=330 (11 items x 3 thresholds x 10 respondents). Using the combined principal component analysis (PCA) of Rasch model residuals and the dependent t-tests procedure, both the HLS_{19}-COM-P-Q11 and the HLS_{19}-COM-P-Q6 were found to be sufficiently unidimensional. Targeting indicates that the respondents have better Communicative HL than captured by the instrument, which increases the risk of ceiling effects (the HLS_{19}-COM-P-Q11 had a mean person location ranging from 1.38 (DE, PAPI) to 2.73 (SI, CAWI) and the HLS_{19}-COM-P-Q6 had a mean person location ranging from 1.21 (DE, PAPI) to 2.47 (SI, CAWI).

The items in the HLS_{19}-COM-P-Q11 displayed acceptable fit, whereas for HLS_{19}-COM-P-Q6, item 10 under-discriminated in four countries (BE, CZ, DK, and HU). In addition, item 4 under-discriminated in the Bulgarian (CAPI and CAWI) and Danish data (CAWI). Some items on the HLS_{19}-COM-P-Q11 displayed DIF for person factors, such as gender, age, and education, but there was no consistent pattern across countries. Response dependency was observed between items 1 and 3 (r=0.35) in the German data. No signs of unordered response categories were found, indicating that the 4-point response scale worked well. For more details about the results of the Rasch analyses, see Guttersrud et al. (2021).

11.2.2.3 Reliability

Both the HLS_{19}-COM-P-Q11 and the HLS_{19}-COM-P-Q6 obtained acceptable values for internal consistency and reliability (Table 11.6) in all countries.

Table 11.6:
Cronbach’s alpha and the Person Separation Index for the HLS19-COM-P-Q11 (left) and the HLS19-COM-P-Q6 (right), for each country and the mean for all countries (equally weighted).

	Q11				Q6									
	AT	DE	SI	Mean	AT	BE	BG	CZ	DE	DK	FR	HU	SI	Mean
Cronbach’s alpha (based on the Pearson correlation)	0.79	0.84	0.87	0.83	0.69	0.80	0.81	0.80	0.74	0.80	0.80	0.79	0.80	0.78
Person Separation Index	0.86	0.89	0.88	0.88	0.75	0.82	0.81	0.83	0.81	0.83	0.83	0.77	0.78	0.80

Source: HLS_{19} Consortium

11.2.2.4 Correlations with other HL scores

The HLS_{19}-COM-P-Q11 and the HLS_{19}-COM-P-Q6 were found to be highly correlated (r=0.94 (AT), r=0.95 (DE), and r=0.96 (SI)) (Table 11.7). The HL-COM score correlated moderately with the GEN-HL score in most countries as well as with the HL-NAV score and, somewhat lower, with Digital HL and Vaccination HL. The association between the scores, as a measure of concurrent discriminant validity, indicates important overlaps between the concepts and measures of the HLS_{19} family of HL, but also indicates the independency of the specific HL measures.

Table 11.7:
Pearson correlations between the HLS_{19}-COM-Q11 (left) and the HLS_{19}-COM-P-Q6 (right) scores and general and other specific HL scores, for each country and the mean for all countries (equally weighted)

	Q11				Q6									
	AT	DE	SI	Mean	AT	BE	BG	CZ	DE	DK	FR	HU	SI	Mean
GEN-HL	0.37	0.54	0.48	0.46	0.34	0.27	0.49	0.47	0.50	0.47	0.52	0.36	0.45	0.43
HL-COM-Q6	0.94	0.95	0.96	0.95	–	–	–	–	–	–	–	–	–	–
HL-DIGI	0.36	0.42	–	0.39	0.32	0.20	–	0.36	0.39	0.31	0.38	0.24	–	0.31
HL-NAV	0.49	0.48	0.45	0.47	0.46	0.36	–	0.45	0.45	–	0.44	–	0.44	0.43
HL-VAC	0.25	0.36	0.34	0.32	0.22	0.25	0.23	0.36	0.34	–	–	0.23	0.33	0.28

Source: HLS_{19} Consortium

11.2.3 Distributions of scores

Table 11.8 reports the distribution of the Communicative HL scores by country. The score can range from 0-100, with 100 representing the highest level of Communicative HL. The mean score indicates the percentage of valid items that were answered on average by the countries or selected population groups with either "easy" or "very easy".

The mean scores are quite high, with means of 90% or higher (AT and SI) and 80% or higher for all other countries, except for DE, which has a mean just above 70%. For all countries, the distributions were rather left-skewed. An overview of the detailed distribution of the Communicative HL score by country can be found in Figure A 11.1 in Annex 11.

Table 11.8:
Means, standard deviations, median and the 25th percentile for the HLS19-COM-P-Q11 (left) and the HLS19-COM-P-Q6 (right) scores, for each country and the mean for all countries (equally weighted)

HL-COM score	**Q11**				**Q6**									
	AT	**DE**	**SI**	**All**	**AT**	**BE**	**BG**	**CZ**	**DE**	**DK**	**FR**	**HU**	**SI**	**All**
Mean	90.2	73.6	91.7	85.2	90.0	83.9	80.7	81.0	72.4	81.8	81.4	86.8	90.4	83.2
SD	16.6	26.4	17.9	22.3	18.4	25.8	27.7	27.4	28.8	26.2	27.2	23.0	20.5	25.8
Median	100	81.8	100	100	100	100	100	100	83.3	100	100	100	100	100
25th percentile	88.9	54.5	90.9	80.0	83.3	83.3	66.7	66.7	50.0	66.7	66.7	83.3	83.3	66.7

The 75th percentiles were 100 in all countries.

Source: HLS19 Consortium

11.2.4 Identification of specific vulnerable/disadvantaged subpopulations

To better identify the subpopulations that could potentially be disadvantaged in terms of Communicative HL, the Communicative HL mean scores for a series of subpopulations were compared to the mean Communicative HL score observed for the whole population. The potentially vulnerable groups considered were: older people, those with the lowest educational level, with a low level in society/low social status, financially deprived people, individuals with poorer self-perceived health status, and those who make frequent use of GPs/family doctors.

The mean HLS_{19}-COM-Q6 scores for the vulnerable subpopulations relative to the total mean scores varied heterogeneously across the different groups. In most countries, people with a lower socio-economic status (self-perceived level in society and financial deprivation) and poorer self-perceived health had a lower Communicative HL score. Similar results were observed using the long version of the scale (Table 11.9). The effect was particularly strong (most differences > 5 points) for level in society, financial deprivation, and bad or very bad self-perceived health. Only in three countries (DE, HU, and SI) did older participants express more difficulties. In the opposite direction, higher Communicative HL scores were observed among older participants in CZ and DK. The relevant numbers of respondents for the selected vulnerable subpopulations are shown in Table A 11.13 in Annex 11.3.

Table 11.9:
Differences between the total mean score and the score for potentially vulnerable subpopulations for the HLS19-COM-Q11 (left) and the HLS19-COM-Q6 (right), for each country and the mean for all countries (equally weighted)

	Q11				Q6									
	AT	DE	SI	All	AT	BE	BG	CZ	DE	DK	FR	HU	SI	All
Total score	90.2	73.6	91.7	85.2	90	83.9	80.7	81	72.4	81.8	81.4	86.8	90.4	83.2
Aged 76 or older	0.2	−4.2	**−6.8**	−3.6	0.6	–	–	**6.8**	−4.4	**7.2**	–	−2.7	**−7.5**	−3.5
Education at ISCED levels 0 or 1	–	–	−4.7	−5.6	–	–	–	−1.3	–	0.1	–	−4.4	−5	−2.9
Level in society less than or equal to 4	−2.9	**−8.9**	−4.1	−5.3	−2.3	**−11**	**−15.5**	**−6**	**−9.6**	**−7.4**	**−9.5**	**−5.9**	−4.1	−7.9
Considerable or severe financial deprivation	**−5.1**	**−11.3**	−3.9	−6.8	−4.4	−2.1	**−14.2**	**−8.1**	**−11.8**	**−14.8**	**−9.5**	**−7.6**	−3.9	−8.5
Bad or very bad self-perceived health	0.5	**−17.5**	**−12**	−9.7	1.9	**−12**	**−26.1**	−3.4	**−17.9**	**−16.6**	**−6.9**	−4	**−13.5**	−10.9
One or more long-term illnesses or health problems	−1.2	−2.5	−3.1	−2.2	−1.3	−0.6	−2.9	0.4	−2.6	−1.8	−0.8	−1.7	−3.6	−1.7
Limited by health problems	−2.6	−3.3	−4.5	−3.5	−2.8	−3.4	**−5.2**	−1.3	−3.4	−4.9	−3.1	**−5.5**	−4.8	−3.8
6 or more contacts with a GP/family doctor	0.5	**−6.5**	−1.8	−2.6	0.7	0.2	**−15.3**	−0.6	**−6.5**	**−5.2**	−2.3	−1.2	−1.9	−3.6

– Cells with less than 30 respondents were not reported. Differences of more than 5 points are **bold**.

Source: HLS19 Consortium

11.2.5 General and specific determinants of Communicative HL

This section includes results on the association of Communicative HL with potential determinants of Communicative HL, such as gender, age, education, level in society, and financial deprivation.

Table 11.10 shows the correlation coefficients between Communicative HL and the General HL score as well as a series of HL determinants. The Communicative HL scores correlated moderately positively with General HL, with Spearman coefficients ranging from 0.31 (BE; Q6) to 0.53 (DE; Q11). The correlation coefficients between Communicative HL and the HL determinants were rather weak in all countries (ρ=0.30), while, on average, somewhat higher for financial deprivation (ρ=−0.16) and level in society (ρ=+0.14) than for the other included indicators.

Table 11.10:
Spearman correlations (ρ) of the HLS_{19}-COM-Q11 (left) and the HLS_{19}-COM-Q6 (right) scores with General HL and HL determinants, for each country and the mean for all countries (equally weighted)

	Q11				Q6									
HL-COM and...	AT	DE	SI	All	AT	BE	BG	CZ	DE	DK	FR	HU	SI	All
GEN-HL	0.38	0.53	0.40	0.55	0.34	0.31	0.41	0.46	0.49	0.41	0.52	0.36	0.37	0.44
Gender female	−0.01	0.01	−0.05	−0.02	−0.01	−0.04	−0.1	−0.07	0	−0.04	−0.07	−0.09	−0.06	−0.05
Age in years	−0.03	0.01	−0.02	−0.02	−0.02	0.23	−0.02	0.23	0.01	0.17	0.11	0.05	−0.05	0.07
Education	0.01	0.17	0.08	0.02	−0.02	−0.02	−0.09	−0.13	0.16	0.08	0	0.09	0.08	−0.02
Level in society	0.04	0.23	0.13	0.09	0.02	0.21	0.27	0.09	0.23	0.16	0.19	0.15	0.12	0.14
Financial deprivation	−0.15	−0.23	−0.19	−0.1	−0.12	−0.1	−0.28	−0.2	−0.22	−0.24	−0.18	−0.23	−0.18	−0.16
Migration background	0.04	−0.05	0	0.04	0.04	−0.09	−0.03	0.01	−0.04	−0.04	−0.02	−0.02	−0.01	0
No training in a health profession	0.03	−0.1	−0.04	−0.04	0.04	−0.01	−0.06	−0.03	−0.08	−0.03	−0.03	−0.04	−0.03	−0.03

Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).
Migration background: 0=none, 1=one parent born abroad, 2=both parents born abroad, 3=born abroad.

Source: HLS_{19} Consortium

The results of the linear regression models are shown in Table 11.11 Model 1 (without General HL) and Table 11.12 Model 2 (with General HL). Multivariable regression models include the simultaneous effect of gender, age, and three measures of social position (education, level in society, and financial deprivation). In the absence of General HL, lower financial deprivation (except BE) and higher self-perceived level in society (except AT) were statistically significant determinants (at the 1%-level) of high Communicative HL with physicians in all countries. The individual effect of gender was only a significant variable in SI, with females having lower levels of Communicative HL. The independent effect of older age in the model was significantly associated with Communicative HL in BE, BG, CZ, DK, and FR. Education was not a significant linear predictor in any country (except for a negative effect in BG and CZ). The proposed model explains 5% of Communicative HL variance, varying between 2% (AT) and 18% (BG).

With the inclusion of General HL in Model 2 (Table 11.12) lower financial deprivation was still a statistically significant determinant of Communicative HL except in BE, FR, and SI. The independent effect of an individual's level in society reached statistical significance in only four countries (BE, DE, FR, and HU). Female gender became a significant determinant in CZ, DK, FR, and SI. Age was a statistically significant independent determinant in five countries (BE, BG, CZ, DK, and FR). Education did not show any significant linear association with Communicative HL in this model except in BG. When the data from all countries were considered, the proposed model explains 22% of the Communicative HL variance, varying between 12% (AT) and 35% (BG).

In general, the models suggest that the level of Communicative HL is mostly explained by General HL but with an independent effect of socio-economic status, mostly by self-perceived level in society and with a smaller effect of financial deprivation, while education, surprisingly, had a lower independent effect. Age had a smaller independent effect, while gender only had minimal effect. The effect of higher General HL, higher socio-economic status, and higher age was related to a higher level of Communicative HL. The results were similar for both the Q6 and the Q11.

When long-term illness was added to the model (Table A 11.14 in Annex 11.4), the effects and the explained variance did not change much despite a negative significant association between long-term illness and Communicative HL in four countries (BG, DE, DK, and SI).

Table 11.11 :
Model 1: Multivariable linear regression models of HL-COM by five core social determinants (standardized coefficients (β) and R2), for each country and for all countries (equally weighted) (Results based on the HLS_{19}-COM-Q11 score to the left and the HLS_{19}-COM-Q6 score to the right).

	Q11				Q6									
HL-COM and…	AT	DE	SI	All	AT	BE	BG	CZ	DE	DK	FR	HU	SI	All
Gender female	−0.02	0.03	**−0.05**	−0.02	−0.02	−0.05	−0.05	−0.03	0.02	−0.04	−0.04	−0.05	**−0.06**	**−0.04**
Age in years	−0.04	−0.02	−0.03	**−0.05**	−0.03	**0.17**	**0.05**	**0.17**	−0.02	**0.12**	**0.06**	0.06	−0.04	**0.05**
Education	−0.02	0.04	0.02	−0.03	−0.03	0.01	**−0.17**	**−0.08**	0.02	0.03	−0.04	0	0.01	**−0.07**
Level in society	0.04	**0.13**	**0.07**	**0.09**	0.03	**0.16**	**0.17**	**0.09**	**0.14**	**0.06**	**0.17**	**0.1**	**0.06**	**0.14**
Financial dep-rivation	**−0.14**	**−0.19**	**−0.14**	**−0.11**	**−0.12**	−0.05	**−0.29**	**−0.19**	**−0.18**	**−0.19**	**−0.12**	**−0.2**	**−0.13**	**−0.13**
R^2	0.03	0.08	0.05	0.03	0.02	0.07	0.18	0.09	0.08	0.08	0.07	0.07	0.04	0.05
Valid count	2677	1837	3177		2672	988	698	1562	1832	3557	2003	1102	3173	
Total count	2967	2143	3360		2967	1000	865	1599	2143	3602	2003	1195	3360	

Coefficients with p-values lower than 0.01 in bold.
Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of -0.005 to +0.005.
Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

Source: HLS_{19} Consortium

Table 11.12:
Model 2: Multivariable linear regression models of HL-COM by GEN-HL and five core social determinants (standardized coefficients (β) and R2), for each country and for all countries (equally weighted). (Results based on the HLS_{19}-COM-Q11 score to the left and the HLS_{19}-COM-Q6 score to the right).

	Q11				Q6									
HL-COM and...	AT	DE	SI	All	AT	BE	BG	CZ	DE	DK	FR	HU	SI	All
GEN-HL	**0.35**	**0.49**	**0.45**	**0.55**	**0.32**	**0.24**	**0.45**	**0.42**	**0.46**	**0.43**	**0.49**	**0.31**	**0.42**	**0.42**
Gender female	-0.05	-0.01	**-0.07**	**-0.04**	-0.05	-0.06	-0.04	**-0.06**	-0.02	**-0.06**	**-0.06**	-0.04	**-0.07**	**-0.06**
Age in years	-0.01	0.03	0.03	0.02	-0.01	**0.17**	**0.09**	**0.13**	0.02	**0.08**	**0.06**	0.02	0.01	**0.06**
Education	-0.01	-0.02	0	-0.02	-0.02	0.02	**-0.21**	-0.02	-0.04	0.02	-0.02	-0.01	-0.01	**-0.04**
Level in society	0.04	**0.08**	0.03	**0.05**	0.03	**0.11**	0.06	0.03	**0.09**	0.02	**0.10**	**0.10**	0.03	**0.09**
Financial dep-rivation	**-0.07**	**-0.11**	**-0.05**	**-0.04**	**-0.05**	-0.06	**-0.22**	**-0.10**	**-0.11**	**-0.11**	-0.04	**-0.12**	-0.05	**-0.07**
R^2	0.15	0.3	0.23	0.31	0.12	0.13	0.35	0.25	0.27	0.25	0.30	0.15	0.21	0.22
Valid count	2677	1837	3177		2672	988	698	1562	1832	3557	2003	1102	3173	
Total count	2967	2143	3360		2967	1000	865	1599	2143	3602	2003	1195	3360	

Coefficients with p-values lower than 0.01 in bold.
Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of -0.005 to +0.005.
Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

Source: HLS_{19} Consortium

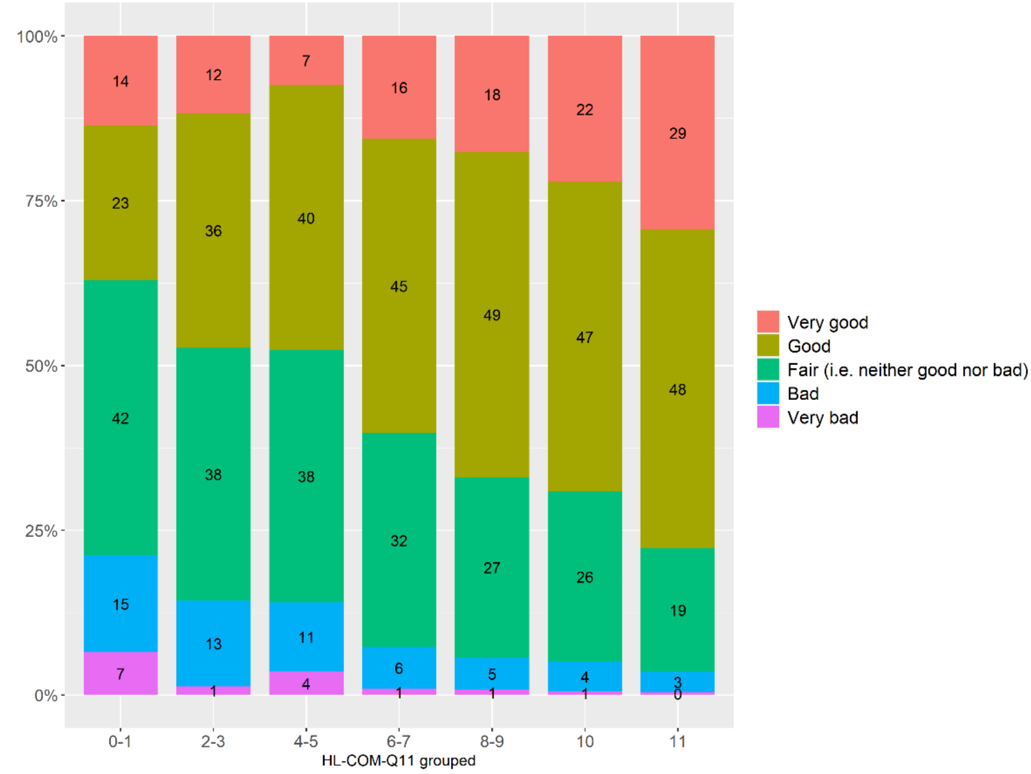
11.2.6 Communicative HL and self-perceived health

This section explores the association between Communicative HL and self-perceived health. Compared to the other chapters, only this potential consequence was focused on because it was hypothesized that self-perceived health could be directly impacted by Communicative HL. Of course, there might be a direct association between Communicative HL and other behavioral indicators (such as smoking or fruit and vegetable consumption), but only if physicians have discussed these topics with their patients. Table A 11.5 in Annex 11.5 confirms the lack of strong and repeated associations between Communicative HL and other indicators. Limitations in activity due to health problems was the only additional indicator showing a correlation coefficient >0.10 with Communicative HL. However, this variable was, as expected, moderately to strongly correlated (ρ=-0.4 to -0.63) with self-perceived health.

Figure 11.6 and Figure 11.7 show that participants with higher Communicative HL scores reported better general health. The association between Communicative HL and general health by country is displayed in Figure A 11.2 and Figure A 11.3 in Annex 11.5. The correlation between Communicative HL and self-perceived health (Table 11.13) was ρ=-0.23 (Q11) or ρ=-0.17 (Q6) when considering the mean of all the countries (see Section 4.2 for information about how the score for all countries is calculated). Except for a null correlation in CZ, it ranged between ρ=-0.13 (HU) and ρ=-0.24 (DK).

In the multivariate regression models adjusted for gender, age, education, self-perceived level in society, and financial deprivation (Model 1, Table 11.13), the association between Communicative HL and better self-perceived health persisted in relation to the mean of all countries and in most individual countries as well (except CZ and HU). After further adjustment for General HL (Model 2, Table 11.13), the explained variance of self-perceived health (R^2) increased only slightly and the association between Communicative HL and self-perceived health decreased but was still statistically significant ($p<0.01$) in relation to the mean of all countries and in most individual countries (except CZ and HU (Q11) or FR and AT (Q6)). The full description of the model in Table A 11.16 in Annex 11.5 highlights the fact that despite being statistically significance, the association between self-perceived health and the Communicative HL score was, on average, weaker than the association between self-perceived health and age, financial deprivation, self-perceived social level in society, or General HL.

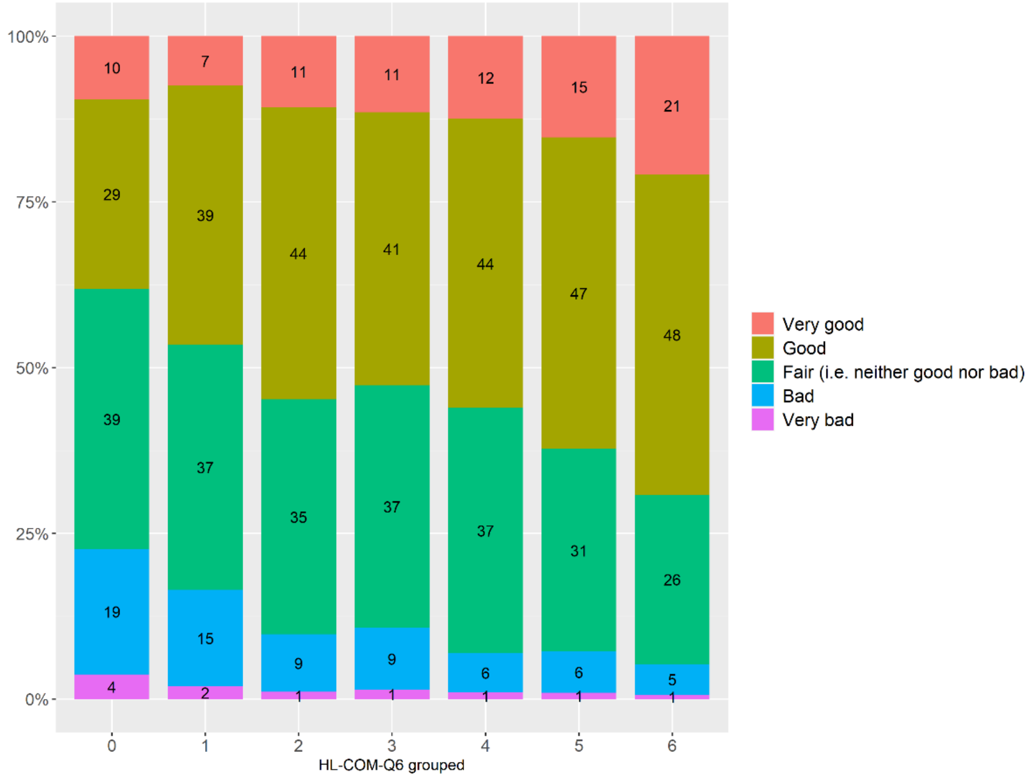
Figure 11.6:
Percentage distribution of five categories of self-perceived health by HL-COM Q11 (7 groups from lowest HL to highest HL), for all countries (equally weighted)



Note: The group levels denote the number of items the respondents answered with “easy” or “very easy”.

Source: HLS_{19} Consortium

Figure 11.7:
Percentage distribution of five categories of self-perceived health by HL-COM Q6 (7 values from lowest HL to highest HL), for all countries (equally weighted)



Note: The group levels denote the number of items the respondents answered with “easy” or “very easy”.

Source: HLS_{19} Consortium

Table 11.13:
Spearman correlation coefficients and standardized coefficients (ß) and R^2 for two linear regression models, for each country and for all countries (equally weighted), illustrating the hypothesized association between HL-COM and self-perceived health (dependent variable)

	Q11				**Q6**									
Self-perceived health*	**AT**	**DE**	**SI**	**All**	**AT**	**BE**	**BG**	**CZ**	**DE**	**DK**	**FR**	**HU**	**SI**	**All**
Spearman correlation coefficient	−0.18	−0.20	−0.20	−0.23	−0.15	−0.21	−0.21	0.00	−0.18	−0.24	−0.16	−0.13	−0.21	−0.17
Standardized beta coefficient (Model 1)	**−0.11**	**−0.17**	**−0.15**	−0.15	**−0.10**	**−0.17**	**−0.21**	−0.06	**−0.15**	**−0.20**	**−0.11**	−0.02	**−0.15**	−0.13
Standardized beta coefficient (Model 2)	**−0.06**	**−0.14**	**−0.11**	**−0.11**	−0.05	**−0.14**	**−0.16**	−0.03	**−0.11**	**−0.13**	−0.04	0.02	**−0.11**	**−0.08**
R^2 (Model 1)	0.14	0.27	0.32	0.24	0.14	0.14	0.35	0.24	0.26	0.15	0.16	0.26	0.31	0.22
R^2 (Model 2)	0.17	0.27	0.32	0.28	0.17	0.15	0.36	0.24	0.26	0.17	0.17	0.28	0.32	0.21

* Self-perceived health: from very good (1) to very bad (5), a higher number represents a worse condition.
Model 1: adjusted for gender, age, education, level in the society, and financial deprivation.
Model 2: same model also adjusted for General Health Literacy as an independent covariate.

Source: HLS_{19} Consortium

11.3 Discussion and Conclusions

The results in this chapter are based on data obtained from a newly developed instrument, the HLS_{19}-COM-P-Q11 and its short version, the HLS_{19}-COM-P-Q6. Previous instruments that were meant to measure Communicative HL were either developed to measure certain communicative tasks or outcomes or to capture only certain aspects of HL. As far as we know, no instrument before integrated findings from communication research and HL research in one instrument. Hence, there was a need for a new measure that covered the HL skills necessary for actively participating in health communication with physicians within a consultation context. The HLS_{19}-COM-P instrument was developed based on a comprehensive theoretical framework that integrates Nutbeam's (2000) idea of Communicative HL, the basic competencies of information processing according to the HL framework of the HLS-EU Consortium (Sørensen et al. 2012), and the main communicative tasks of the Calgary-Cambridge Guide framework (Silverman et al. 2013).

The HLS_{19}-COM-P instrument was well accepted in a huge sample (n>20,000 for the HLS_{19}-COM-P-Q6) in nine countries and seven languages with different formats of data collection (CAPI, CATI, etc.). Both the HLS_{19}-COM-P-Q11 and the HLS_{19}-COM-P-Q6 displayed acceptable psychometric properties at overall level and at item level alike. However, there is room for some improvements, e.g., the wording of item 10, which tended to under-discriminate in the short version, and some items displaying DIF for levels of person factors, for example gender, age, and education. The HLS_{19}-COM-P instrument has proven to map Communicative HL in research on a population level and might have the potential to map Communicative HL in clinical settings as well. However, the HLS_{19}-COM-P should be validated for use in such settings in advance. The short version might give a general overview of Communicative HL, while the long version provides more detailed information on individuals' Communicative HL with physicians.

As expected, the short version correlated strongly with the long one and moderately with the General HL instrument. Thus, the HLS_{19}-COM-P instruments add valuable information about individuals' Communicative HL with physicians. The HLS_{19}-COM-P also correlated moderately with the HLS_{19}-NAV, indicating that Communicative HL in consultations with physicians is also important for supporting the navigation tasks of health care users, although it still has to be regarded as a distinctive construct.

A majority of the respondents found the Communicative HL tasks relatively easy. However, there were still approximately 10% to 25% who found Communicative HL tasks difficult and might not have sufficient Communicative HL proficiency to actively participate in communication with physicians. In general, to get enough time in the consultation with the physician and to express one's personal views and preferences to the physician were experienced as the most difficult tasks, while explaining health concerns was the easiest. In consultations with patients with low Communicative HL, physicians should set aside more time to be able to provide adapted information and to be able to better facilitate active participation in the consultation. The difficulties to express one's personal views and preferences might indicate the need for more patient empowerment in shared decision making (Elwyn et al. 2016; Meijers et al. 2019). As consultation time is the most important difficulty in Communicative HL, it is essential that organizational contexts are developed to support patient-oriented communication in the framework of health literate health care organizations (Palumbo 2021; Pelikan 2019; Working Group HPH & HLO 2019; Brach et al. 2012).

General HL was found to be the strongest predictor for Communicative HL. This is in accordance with earlier research showing that patients with lower HL report worse communication with their providers than those with higher HL (Castro et al. 2007; Schillinger et al. 2004) and are less active in these communications (Katz et al. 2007). In most countries, participants with lower socio-economic status (level in society and financial deprivation) and poorer health were found to have lower HLS_{19}-COM-P mean scores than those with higher socio-economic status and better health. In most countries higher Communicative HL was associated with better general self-perceived health. This would be in line with previous research that describes Communicative HL as a critical determinant of successful disease management and health outcomes (van der Heide et al. 2018; Amalraj et al. 2009; Paasche-Orlow/Wolf 2007). Conversely, there might also be the possibility that people in good health assess their Communicative HL to be better because they have not had enough problematic experiences with physicians.

Limitations

It should be acknowledged that the results and conclusions do have limitations due to the cross-sectional design of the study and possibly due to the diversity of data collection modes used by countries (and within countries), so that a comparative analysis between participating countries is only possible to a limited extent.

The main limitation to the instrument is that it only measures Communicative HL between physicians and patients. Healthcare systems are diverse in relation to the importance of physician-patient interactions so generalizations on the quality of the communicative culture in health care and its impact on health issues might be limited.

Finally, there might be a limitation relating to the ability to recall personal experiences of physician-patient interactions because of diverse factors like the time since the last interaction, the frequency of interactions, individual dependence on health care, and cognitive skills, etc. Hence, the Communicative HL results might be influenced by these factors.

From these results and their limitations, some conclusions for future research follow:

- to improve minor under-discriminating items,
- to investigate the link between **gender**, **social gradient**, **dealing with chronic illness**, and Communicative HL,
- to investigate the link between **HLS_{19}-NAV** and HLS_{19}-COM-P,
- to test the **stand-alone use** of the HLS_{19}-COM-P instruments, specifically in the clinical context as well,

» to adapt the HLS_{19}-COM-P instruments as a measure for Communicative HL in relation to **other health professionals** (nurses, physiotherapists, etc.). However, it is strongly recommended that such an adaptation of the instrument should be thoroughly piloted and assessed to ensure its validity and reliability.

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12 Digital Health Literacy

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12.1 Background and development of the new instrument

The increasing availability and use of health-related digital/electronic resources such as electronic health records, telehealth initiatives, digital health applications, interactive communication options with health care providers (e.g., for making appointments or reporting medical results) places a growing demand on the population's skills to use these applications and resources. Health care organizations and governments often encourage, initiate, and develop digital resources which require cognitive domain skills, including understanding, appraising, and applying health information, but also specific skills, such as skills for navigating digital health information. Researchers, practitioners, and policy makers should therefore acknowledge the importance of people's proficiency in using digital resources for managing disease and/or promoting people's health.

The amount of information on disease management, prevention and health promotion that is available and the number of channels that are used for disseminating this information have accelerated in the process of digitalization. Due to the ubiquitous nature of digital communication, commercial companies and individuals are also seeking the public's attention through digital channels. As a result, more interest-driven, manipulative, or simply false information is circulated to the public, requiring particularly critical and analytical skills from the public and individual users (Paige et al. 2018).

Whether increased digitalization for health moves societies towards better health for all, leaving no one behind or, alternatively, widens the digital divide between populations, remains a point of discussion (Levin-Zamir/Bertschi 2018). To address this issue, a better understanding of the scope and importance of Digital Health Literacy (DHL) is necessary. For that reason, a measure of DHL was included as an option in the HLS19 study, as part of the "HLS family", along with the other specific literacies that were included in the national surveys.

In this chapter we will use the term *Digital HL*, in accordance with the concept of digital literacy (American Library Association, 2013). This term is preferred to *eHealth literacy* by the authors. While eHealth and Digital Health are often used interchangeably and are closely related, eHealth is interpreted as focusing mainly on healthcare, while the term Digital Health is more inclusive and relates also to mHealth (mobile), artificial intelligence and other emerging areas of innovation and information technology (WHO, 2018).Overview on relevance, existing research, and measures of Digital HL

The need to assess people's use of electronic sources of health-related information was first recognized by Norman/Skinner (2006), who used the term eHealth literacy and defined it as "the ability to seek, find, understand, appraise health information from electronic sources and apply the knowledge gained to addressing or solving a health problem". In accordance with this definition, they developed the self-report measure eHealth Literacy Scale (eHEALS), assessing skills to find and evaluate health information on the Internet. However, the rapid development of digital health resources, beyond information seeking from the Internet which was the only digital resource available when the above-mentioned definition was established, warrants new thinking regarding definitions and measurement tool development. Subsequently, eHealth literacy has been commonly assessed in health-related studies (Karnoe/Kayser 2015). Furthermore, eHealth Literacy along with media health literacy has been conceptualized as the interplay of personal, situational, and contextual factors, and their interactions (Levin-Zamir/Bertschi 2018). A plethora of studies have examined eHealth literacy and Digital HL respectively throughout the lifespan, from childhood and adolescence (Levin-Zamir et al. 2011; Livingstone et al. 2017; Yang et al. 2017) through adulthood and among the elderly (Choi/DiNitto 2013; Leung et al. 2007). Additionally, Digital HL has been examined with respect to cultural transition (Levin-Zamir et al. 2017), to specific health conditions (Saha et al. 2017), and to specific health behaviors (Aharony/Goldman 2017), but studies on performance based eHealth literacy are still scarce (Neter/Brainin 2017; van der Vaart et al. 2011). Empirically, General HL and eHealth literacy are different but related concepts (Neter et al. 2015).

A recent study refers to Digital HL as the individual, social and technical competencies and resources that are important for searching, finding, understanding, evaluating, and applying digitally health information (Zeeb et al. 2021). According to Bittlingmayer et al. (2020) Digital HL refers not only to navigation in digital space and use of digital resources and their evaluation (e.g., health apps, social media, information sites on the Internet), but also to the significantly increased individual "option spaces" that arise with digitalization and the related availability of health information.

Yet, while eHEALS has been extensively used to assess the self-reported use of electronic sources for health information, the past decades have offered many additional opportunities to promote health through digital sources, thus widening the scope of the digital health skills that are needed by individuals to maximize the potential for applying digital resources for health. To capture these skills, a broader self-report scale, which also addresses the interactive task of adding content, was developed, and validated in the Netherlands (DHLI; Van Der Vaart/Drossaert 2017). While it well captures various aspects of Digital HL, to our knowledge at the time of the HLS_{19} study, this scale has not been applied/field tested in large samples.

It should be acknowledged that during the COVID-19 pandemic, the need for learning about the public's potential response to digital resources, including the way in which these resources can help mitigate the pandemic and promote health, significantly increased. Several surveys were launched, including the cross-sectional international survey among university students in Germany and other countries (Dadaczynski et al. 2021), using the Digital Health Literacy Instrument (DHLI), based on 5 subscales adapted to the specific context of the COVID-19 pandemic. The Digital Health Equity Framework was also developed during the COVID-19 pandemic, due to concern over the potential of increased social disparities because of disparities in access and use of digital health resources (Crawford/Serhal 2020).

In conclusion, valid and reliable information about people's Digital HL can help health authorities to discern the patient and public experience and difficulties in dealing health information from digital sources, including the extent to which these resources are apparent, accessible, understood, evaluated, and applied. For that reason, Digital HL was included as an optional package in HLS_{19}.

12.1.1 Rationale for providing a new measure and procedure of developing the measure and specific correlates for the measure in HLS_{19}

While Digital HL has been assessed in few countries and in the European Region (Comission 2014; Zrubka et al. 2020), these assessments mainly used the eHealth measure (eHEALS) or similar instruments. These studies have not looked at Digital HL in the broader societal context and not provided relevant associations with other aspects of HL. Furthermore, there are no international comparative studies on Digital HL. To our knowledge, apart from national studies conducted as part of HLS_{19} and already published (Le et al. 2021; Schaeffer et al. 2021, and others), to date no national HL survey has assessed and compared Digital HL to General HL. Also, even at a national level, there are no studies that have examined the determinants of Digital HL and its contribution to General HL or to health promoting behavior, healthy lifestyles, early detection of diseases, or self-care in the case of long-term illness, and use of health services.

HLS_{19} offered an opportunity to develop and evaluate/validate a new measure for Digital HL, to report Digital HL at the general adult population level, and to study its association with General HL, with socio-demographic-economic and other determinants and with possible health-related consequences and outcomes.

A working group including experts was established to develop the instrument and select potential personal factors and covariates relevant for explaining variance in Digital HL.

12.1.2 Definition and the Concept of Digital HL in HLS_{19}

The concept of Digital HL, adopted in HLS_{19}, is based on the conceptual model, definition, comprehensive understanding, and operational matrix of General HL proposed by the HLS-EU consortium (Sørensen et al. 2012), yet aligned with existing research on the scope and diversity of digital health resources. The concept refers to the health-related use of updated digital technologies and resources, such as social media, health apps, wearables, and personal health records/interaction with healthcare providers.

The HLS_{19} concept of Digital HL for promoting health includes the ability to search for, access, understand, appraise, validate, and apply online health information, the ability 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. The HLS_{19} Digital HL optional package was developed with the purpose of capturing these aspects of Digital HL.

The HLS_{19} Digital HL optional package measure

The HLS_{19} optional package on Digital HL includes the ability to search for, access, understand, appraise, validate, and apply online health information (measured by eight items and referred to as HL-DIGI), and the ability to clearly formulate questions, opinions, thoughts, or feelings when *interacting* by typing/posting on a digital device (measured by two items), referred to as HL-DIGI-INT. These ten items were aligned with the HLS_{19} template by asking how easy or difficult it is to perform the tasks. The analysis of the two parts was conducted separately, as the psychometric analyses identified them as separate dimensions. The instrument for measurement is heavily based on the conclusions of a previous study on the development of the DHLI mentioned above (Van Der Vaart/Drossaert 2017). That instrument was adjusted for current use in the HLS_{19} study to ensure a better alignment with the health literacy model adopted by the rest of the HLS_{19} study, applying the conclusions and recommendation of the authors of the previous study for measuring on a population level. Redundancy on the topic of applying health information was eliminated, and the dimension of understanding health information accessed digitally, which was not part of the original measure, was added to align with the definition of DHL. Furthermore, the questions regarding privacy that appear in the DLHI tool were not included, as the authors themselves mentioned in the Discussion that this dimension might not be useful in future studies.

In the current study, a cluster of six additional items was added to collect information on the frequency with which people use different digital sources and resources for promoting their health. Included in the terms 'digital sources and resources' are websites, social media, digital devices related to health or health care, or digital interaction with one's health system (such as online video consultations, digital personal health records, health related apps on mobile phone, etc.).

12.1.3 Objectives and research questions of the Digital HL optional package

Considering Digital HL as an asset, the ultimate purpose of including measures of Digital HL in the HLS_{19} survey was to provide evidence-informed recommendations that could drive health promoting policy.

The research questions were:

1. What are the psychometric properties of the new eight-item HL-DIGI scale?
2. How are HL-DIGI score and the two items set on interactive digital devices (HL-DIGI-INT) distributed in general populations and sub-populations?
3. How closely are Digital HL and General HL, measured by HLS_{19}-Q12, related?
4. To what extent are the related traits of Digital HL, and General HL, measured by HLS_{19}-Q12, empirically different?
5. What are relevant determinants of Digital HL, based on the background variables available in the HLS_{19}? To what extent is there a social gradient for Digital HL?
6. How is the scope of self-reported usage of different digital health resources for promoting health, related to Digital HL?

7. What are relevant consequences of Digital HL, based on health-related personal outcome variable and covariates available in HLS_{19}?

12.1.4 Countries participating in the Digital HL Optional Package

The following countries included the optional package on Digital HL in their national assessment (in alphabetical order): 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), but for France this optional package was only included in the second wave of data collection with 1,000 respondents. Analyses were based on 28,057 respondents, with country specific sample sizes ranging from 1,000 to 3,602. As indicated in Chapter 2.4, there was a variation in data collection method (CAPI, CATI, CAWI, PAPI and mixed) among, but also within, countries as some countries applied different collection methods for different sub-populations. The participation in a CAWI interview necessitates some familiarity with digital medias. CAWI interviews were used exclusively in BE, DK, and FR. Parts of the surveys were done via CAWI in CH, CZ, and IL.

12.2 Methods of analyses and results

The specific measures for the optional package Digital HL consist of three blocks:

1. Use of digital resources (6 items)
2. Digital health literacy (8 items)
3. Interaction with digital devices (2 items).

For the items on the use of digital media, respondents replied to the question "In a typical week, how many days do you use the following digital resources for getting health related information" for websites, social media, digital devices, mobile health apps, eHealth, or other digital resources (see Annex 12.4). The response categories were: "Not relevant for me" or "Less than once per week", "1-3 days per week", "4-6 days per week", "Once a day", or "More than once per day". A mean score (ranging from 1 "Not relevant or less than once per week" to 5 "More than once per day") was 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. This item set was not included in the questionnaire of the Norwegian survey, which is why Norway is missing in the respective tables and figures.

To analyse and report on Digital HL, a scale measuring the skills related to seeking health information digitally (HL-DIGI) was constructed. This scale consists of eight questions related to tasks on how easy or difficult it is to search for, find, understand, and judge health information from digital sources. The internal consistency and the unidimensionality of the scale were verified by means of the Cronbach alpha coefficient, confirmative factor analyses, and Rasch analyses. The HL-DIGI-HI scale data were tested up against the unidimensional Rasch partial credit model (PCM). For each country, overall data-model fit, single item fit, the ordering of response categories, response dependency, one-dimensionality, and differential item functioning (DIF) were evaluated.

As for the HLS_{19} General HL measure, the Digital HL scores are based on a count of the dichotomized items, combining categories “easy” and “very easy” and “difficult” and “very difficult”, respectively. The resulting score was standardized to the range of 0 to 100, as per the procedure of HLS_{19}. As such, the score indicates the percentage of items that are considered as “easy” or “very easy” by a respondent. Scores were only computed for respondents who had answered at least 80% of the items.

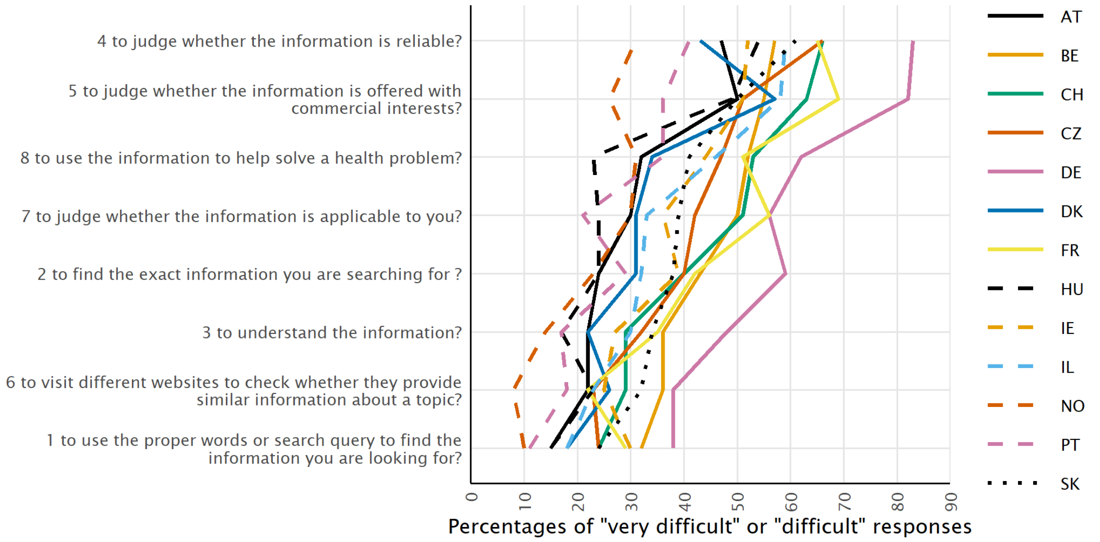
For difficulty of interaction with Digital Devices (HL-DIGI-INT), two questions that focus on reported difficulty of tasks for interacting with digital health resources were used. The correlation between Digital HL with these combined to an index is considerable (r=0.48), but low enough to justify two different measures.

For the visualization of the perceived difficulties at item level, the response categories "very difficult" and "difficult" were combined (Figure 12.1). Average Percentage Response Patterns (APRP) (for details see chapter 4.4) (Figure 12.2) and the (mean) scores (Table 12.6) for HL-DIGI were used to report on Digital HL. APRP indicate the average percentages for all eight items of the measure, answered by each of the four response categories. The APRPs displays the percentages with which the four response categories, on average, were used when responding to the eight items by a specific population. For the calculation of the APRP for the HL-DIGI, the average number of times (out of eight items) respondents used each response category while responding to the eight items, was estimated.

12.2.1 Distributions of individual items of measuring Digital HL

This section describes an overview of the valid responses for perceived difficulties (“very difficult” and “difficult”) for the items of the HL-DIGI scale (Figure 12.1, Table 12.1) and the two-item set on interactive digital devices for each country (Table 12.2) as well as the APRPs for each country and for all countries (equally weighted) for the HL-DIGI scale and the two-item index (Figure 12.2, Figure 12.3).

Figure 12.1:
Percentages of respondents who responded with “very difficult” or “difficult” to the HL-DIGI items (ordered by the overall mean), for each country and the mean for all countries (equally weighted)



Source: HLS19 Consortium

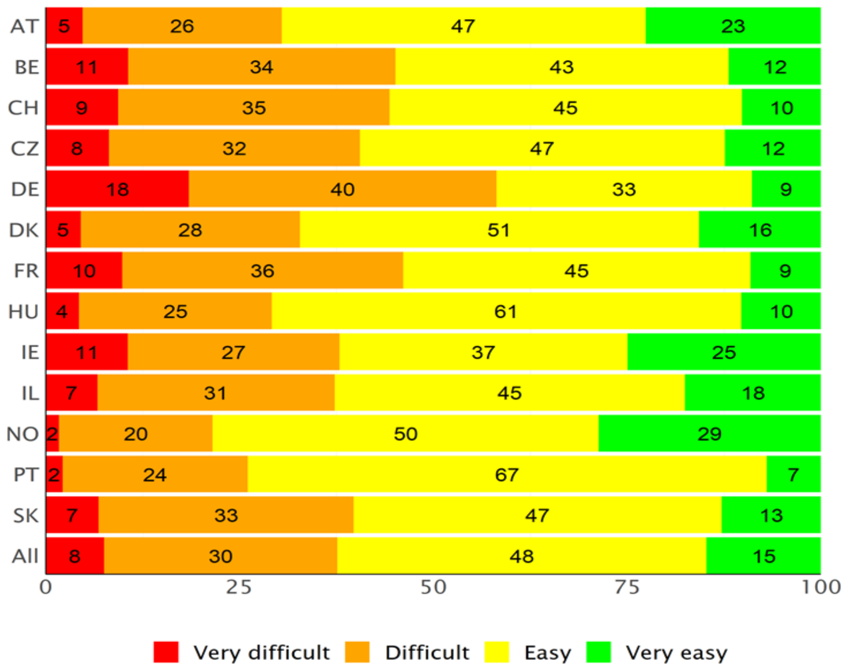
Regarding the single items that comprise the HL-DIGI scale (Figure 12.1), ranking of combined difficulty response categories of tasks across countries is rather similar with some exceptions. The percentages of combined “difficult” and “very difficult” answers (Table 12.1), range (for all countries weighted equally) from 21.8% for the on average easiest item 1, “to use the proper words or search query to find the information you are looking for” to 54.1% for perceived difficulty of the on average most difficult item 4 “to judge whether the information is reliable”. For both items, there is a considerable variance in difficulties across countries with the data from NO and DE as minimum and maximum. For item 1 the perceived difficulty ranges from 9.5% (NO) to 38.5% (DE). For item 4, the perceived difficulty ranges from 30.6% (NO) to 82.6% (DE). Percentage distributions for all four categories, for each item, are provided in Annex 12.1 for each country and for the mean of all countries (equally weighted) (Table A 12.1 to A 12.8, respective Tables A 12.23, and A 12.24). For some countries, non-response rates for some items were markedly higher (35% (PT), 23% (IE), 20% (CZ), 20% (HU), 19% (NO), 17% (AT)) than for the other HL measures used in HLS19. This is to some extent a result of how non-users were handled in these countries, some of which used filter questions. As a result, the samples may not be representative of the full country samples, for example in Ireland, those missing have a higher mean age to the total sample and a lower mean education level. Spearman correlations of the 8 items with each other are shown in Annex 12.2 (Tables A12.9 to A12.22), for individual countries and for all countries. Figure 12.2 shows the APRP for the items of HL-DIGI scale. Nearly two-fifths of the mean of all countries report difficulties, while this proportion ranged from 22% (NO) to 58% (DK).

Table 12.1:
Percentages of respondents in each country who responded with "very difficult" or "difficult" to the HL-DIGI items (ordered by the mean for All), for each country and the mean for all countries (equally weighted)

	AT	BE	CH	CZ	DE	DK	FR	HU	IE	IL	NO	PT	SK	All
4. to judge whether the information is reliable?	46.9	57.1	66.0	65.8	82.6	43.1	64.8	53.7	51.6	58.6	30.6	41.2	61.2	54.1
5. to judge whether the information is offered with commercial interests?	49.7	55.1	63.2	51.3	82.1	57.0	69.2	49.0	50.9	58.4	25.9	36.1	50.4	53.6
8. to use the information to help solve a health problem?	31.7	51.6	52.7	47.3	61.9	34.4	51.4	23.4	44.1	46.2	31.4	35.5	40.8	42.0
7. to judge whether the information is applicable to you?	29.9	49.7	51.0	41.6	56.3	31.0	55.7	23.7	36.0	32.9	29.7	21.0	38.6	37.8
2. to find the exact information you are searching for?	23.7	42.6	40.5	39.9	58.9	31.3	41.7	24.1	38.7	31.6	22.8	28.6	37.8	35.0
3. to understand the information?	22.3	36.4	29.0	32.0	47.5	21.9	34.9	16.8	27.2	29.8	14.2	16.6	33.5	26.9
6. to visit different websites to check whether they provide similar information about a topic?	22.2	36.3	28.7	23.1	37.9	26.2	22.1	22.7	24.7	22.9	7.6	17.7	31.5	25.0
1. to use the proper words or search query to find the information you are looking for?	15.1	32.3	23.6	23.7	38.5	17.8	29.3	15.4	29.9	18.0	9.5	10.8	24.0	21.8

Source: HLS_{19} Consortium

Figure 12.2:
Average Percentage Response Patterns (APRP) for the HL-DIGI scale, for each country and mean of all countries (equally weighted)



Source: HLS19 Consortium

Difficulty of interaction with digital devices

The ease or difficulty with which respondents estimated their ability to interact with digital devices was assessed using a two-item set on interaction with digital devices. The ranking of difficulty of tasks is similar across countries with one exception, where both items are equally difficult. On average, item 1 "to clearly formulate your written message when communicating with a health provider" was easier (on average 26.8% responded “difficult” or “very difficult”, varying from 9.6% (PT) to 45.4% (SK)) than item 2 "to express your opinion, thoughts or feelings, ask a question in writing on social media including online forums" (on average 35.6% responded “difficult” or “very difficult” ranging from 14.0% (PT) to 50.6% (SK)).

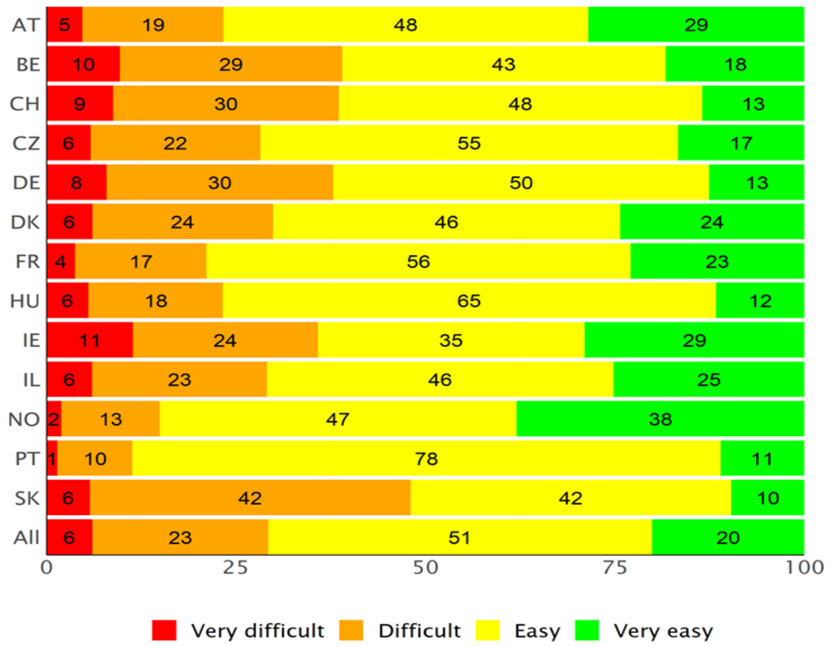
Table 12.2:
Percentages of respondents in each country who responded with "very difficult" or "difficult" to the two items on interaction with digital devices (HL-DIGI-INT) (ordered by the mean for the All), for each country and the mean for all countries (equally weighted)

	AT	BE	CH	CZ	DE	DK	FR	HU	IE	IL	NO	PT	SK	All
2 express your opinion, thoughts, or feelings, ask a question in writing on social media including online forums?	27.0	42.3	43.5	30.5	39.3	35.9	24.0	22.9	42.8	31.9	20.2	14.0	50.6	35.6
1 clearly formulate your written message when communicating with a health provider?	22.8	35.7	34.5	26.9	35.6	24.2	17.7	23.9	31.0	26.3	10.2	9.6	45.4	26.8

Source: HLS_{19} Consortium

Figure 12.3 shows the APRP for the two items on interaction with digital devices. On average, more than one-quarter of respondents (29% responded "difficult" or "very difficult", varying by country from 11% (PT) to 48% (SK)) reported difficulties with these two tasks, while 51% of the respondents (varying from 35% (IE) to 78% (PT)) experienced the tasks as easy and 20% (varying from 10% (SK) to 38% (NO)) as very easy.

Figure 12.3:
Average Percentage Response Patterns (APRP) for an index of the two items on interaction with digital devices (HL-DIGI-INT), for each country and mean of all countries (equally weighted)



Source: HLS19 Consortium

12.2.2 Validity and psychometric properties of the Digital HL scale

Internal consistency or "test reliability" (i.e., the measure's ability to distinguish between respondents with different proficiency) was estimated by Cronbach's alpha coefficient (cf. Chapter 4.7). The Cronbach's alphas for the HL-DIGI score are above 0.7 for each country (Table 12.3).

For the eight items of the HLS_{19}-DIGI score, single-factor confirmatory factor model with dichotomized items loading on a single latent variable was estimated for each country. The fit indices generally indicate an acceptable fit in all countries (Table 12.4). The standardized root mean square residual (SRMSR) (assuming a 0.08 threshold value) and the lower bound of the confidence interval of the root mean square error of approximation (with 0.05 as threshold) are slightly suboptimal for most countries hinting at some possible misfit between the observed data and the single-factor model. Other fit indices (comparative fit index, the Tucker-Lewis index, the goodness of fit, and the adjusted goodness of fit index) generally indicate a sufficiently good fit between the observed covariance matrix and the model implied covariance matrix for all countries (cf. Chapter 4.7.2 for the applied thresholds).

Table 12.3:
Cronbach's alphas for the HL-DIGI scale, for each country and mean of all countries (equally weighted)

	AT	BE	CH	CZ	DE	DK	FR	HU	IE	IL	NO	PT	SK	Mean
HL-DIGI	0.81	0.86	0.85	0.82	0.83	0.86	0.86	0.79	0.79	0.83	0.77	0.83	0.87	0.83

Source: HLS19 Consortium

Table 12.4:
Fit indices for the one-factor confirmatory factor model with the eight HL-DIGI items as indicators, for each country and mean of all countries (equally weighted)

	AT	BE	CH	CZ	DE	DK	FR	HU	IE	IL	NO	PT	SK	Mean
Standardized Root Mean Square Residual	0.07	0.12	0.08	0.07	0.07	0.09	0.06	0.10	0.06	0.08	0.07	0.07	0.07	0.08
Root Mean Square Error of Approximation	0.08	0.13	0.09	0.07	0.08	0.11	0.07	0.10	0.06	0.08	0.06	0.08	0.08	0.08
Root Mean Square Error of Approximation (p Value)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.05	0.00	0.00	0.01
Comparative Fit Index	0.98	0.98	0.99	0.99	0.99	0.98	0.99	0.96	0.99	0.99	0.98	0.99	0.99	0.98
Tucker-Lewis index	0.97	0.97	0.98	0.98	0.98	0.98	0.99	0.94	0.98	0.98	0.98	0.98	0.99	0.98
Goodness of Fit Index	0.98	0.97	0.99	0.98	0.99	0.98	0.99	0.97	0.99	0.99	0.99	0.99	0.99	0.98
Adjusted Goodness of Fit Index	0.97	0.95	0.98	0.97	0.98	0.97	0.98	0.94	0.98	0.97	0.98	0.98	0.98	0.97

Source: HLS19 Consortium

A Rasch analysis was conducted to examine the unidimensionality of the scale (cf. Chapter 4.7.3). When an amended sample size corresponding to 20 respondents for each of 24 thresholds (n=480) was used, the overall data-model fit was sufficient (χ^2statistic) for data collected in Austria (CATI), Germany, Ireland, Norway, and Switzerland. Acceptable fit for data collected in Belgium and Czech Republic was also observed. With a reduced sample size of n=240 or 10 respondents per threshold, the data collected in Denmark, Hungary, Israel, and Portugal displayed acceptable overall data-model fit as well. Data from France and Slovakia was not included in the Rasch analysis because it was not available yet at the time of analysis.

According to a principal component analysis (PCA) of Rasch model residuals combined with dependent t-tests to identify possible empirical subscales the HLS_{19}-DIGI scale was sufficiently unidimensional. The thresholds, and thus the response categories, were ordered and well-functioning. No significant statistical dependence between pairs of items were observed, which means that no items are "too similar" and collect redundant information.

Item 5 "to judge whether health-related information is offered with commercial interests" tends to discriminate somewhat poorly across most countries. Hence, this item does not strictly conform to the latent trait underlying the scale. Some items display DIF for person factors, such as age and gender, but there is no consistent pattern across countries. Furthermore, the HLS_{19}-DIGI scale does not measure invariantly across countries as the item location or "difficulty order" varies between countries (cf. Figure 12.1). This may be ascribed to DIF for country or language.

Table 12.5 displays the correlation coefficients for the HL-DIGI score with General HL (GEN-HL), as well as with other specific HL scores measured in HLS_{19}, such as Navigational HL (HL-NAV). Overall, the strongest correlations are observed between Digital HL and General HL (0.53), and between Digital HL and Navigational HL (HL-NAV) (0.55).

Table 12.5:
Pearson correlation (r) between HL-DIGI score and the specific scales measuring HL in HLS_{19}, for each country and all countries (equally weighted)

	AT	BE	CH	CZ	DE	DK	FR	HU	IE	IL	NO	PT	SK	Mean
HLS_{19}-Q12	0.46	0.44	0.49	0.57	0.59	0.54	0.59	0.5	0.49	0.67	0.48	0.55	0.54	0.53
HL-COM-Q11	0.36	–	–	–	0.42	–	–	–	–	–	–	–	–	0.39
HL-COM-Q6	0.32	0.2	–	0.36	0.39	0.31	0.38	0.24	–	–	–	–	–	0.31
HL-NAV	0.57	0.36	0.52	0.57	0.59	–	0.67	–	–	–	–	0.54	–	0.55
HL-VAC	0.33	0.39	–	0.39	0.34	–	–	0.45	0.33	–	0.38	0.41	–	0.38

Source: HLS_{19} Consortium

12.2.3 Distributions of HL-DIGI score measures

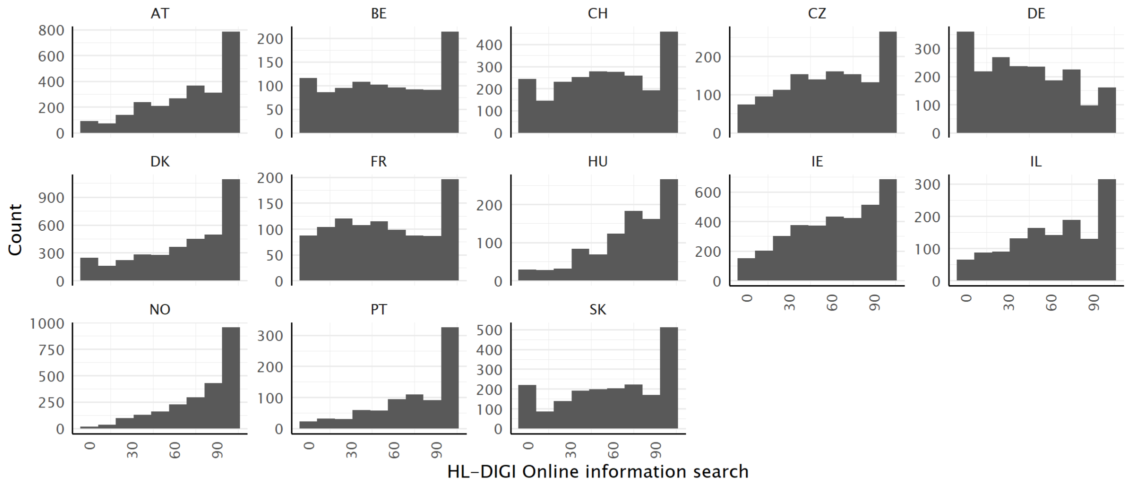
Table12.6 reports the distribution of HL-DIGI scores and Figure 12.2 displays the distribution visually. The score values range from 0 to 100. A higher value indicates a higher level of HL-DIGI. The mean score over all countries (weighted equally) is 62.3, varying between 41.8 (DE) and 78.7 (NO). For most countries the distribution is left skewed with the 75% quantile starting at the maximum value, indicating a ceiling effect for the measure (Figure 12.4).

Table 12.6:
Means, standard deviations, medians, and quartiles of the HL-DIGI scores, for each country and for all countries (weighted equally)

	Mean	SD	25th percentile	Median	75th percentile
AT	70.1	29.2	50.0	75.0	100.0
BE	54.9	34.6	25.0	50.0	87.5
CH	55.7	33.0	25.0	62.5	87.5
CZ	59.3	31.4	37.5	62.5	87.5
DE	41.8	31.6	12.5	37.5	62.5
DK	67.2	32.2	37.5	75.0	100.0
FR	53.9	33.5	25.0	50.0	87.5
HU	71.8	26.9	62.5	75.0	100.0
IE	62.1	30.2	37.5	62.5	87.5
IL	62.7	31.0	37.5	62.5	87.5
NO	78.7	24.7	62.5	87.5	100.0
PT	74.0	28.7	57.1	85.7	100.0
SK	60.3	34.2	37.5	62.5	100.0
All	62.3	32.5	37.5	62.5	100.0

Source: HLS_{19} Consortium

Figure 12.4:
Histograms of the distribution of the HL-DIGI scores, for each country



Source: HLS19 Consortium

12.2.4 Identification of specific vulnerable/disadvantaged subpopulations

To identify the subpopulations that could potentially be disadvantaged in terms of the Digital HL, the HL-DIGI mean scores were compared for selected potential vulnerable or disadvantaged subpopulations to the mean HL-DIGI score observed for the whole population. The vulnerable subpopulations being considered were older people, people with the lowest educational level, people with a low self-reported social status/level in society, financially deprived people, people with poorer health status, and people who most frequently use healthcare services. The results are shown in Table 12.7.

On average, old age (-12.0) showed the strongest deviation from the whole population, followed by (very) bad self-perceived health (-11.4), by strong financial deprivation (-8.7), by low education (-7.8), for many contacts with GPs/family doctor (-6.9) low level in society (-6.8), while the two healthcare-related indicators showed less deviation, for limited health problems (-4.7) and for having long-term illnesses or health problems (-3.2). For most indicators variation between countries was considerable.

Table 12.7:
Differences in mean HLS19-DIGI score between the country sample and selected vulnerable subpopulations, for each country and the mean for all countries (equally weighted)

	AT	BE	CH	CZ	DE	DK	FR	HU	IE	IL	NO	PT	SK	Mean
HL-DIGI country mean	70.1	54.9	55.7	59.3	41.8	67.2	53.9	71.8	62.1	62.7	78.7	74	60.3	62.5
Aged 76 or older	−9.7	−5.8	−16	−2	−23	−11.6	–	−18.3	−11.5	−4.9	−8.4	1.7	−34.9	−12.0
Education at ISCED levels 0 or 1	−20.2	7.6	−10.6	1.5	−8.4	−24.1	6.2	−6	−11.1	−8.8	3.4	−9.9	−20.7	−7.8
Level in society less than or equal to 4	−2.2	−5.8	−5.9	−3.7	−8.2	−9.5	−4.3	−5.8	−4.7	−9.1	−4.3	−6	−19	−6.8
Considerable or severe financial deprivation	−11.3	−2.4	−4.9	−8	−10.4	−9.6	−4.7	−9.6	−8.7	−7.3	−13.4	−8.7	−14.5	−8.7
Bad or very bad self-perceived health	−8.3	0.4	−9.1	−4.4	−23	−8.9	−11.9	−9.8	−10	−9.2	−9.6	−21.5	−23.3	−11.4
One or more long-term illnesses or health problems	−4.1	−1.4	−4.7	−1.2	−3.3	−2.7	−1.7	−4.7	−0.6	−3	−1.2	−8.2	−4.7	−3.2
Limited by health problems	−6.6	−3.3	−4.7	−3	−4.7	−5.2	−0.7	−7.2	−2.9	−1.7	−2.3	−9.3	−9.8	−4.7
6 or more contacts with a GP/family doctor	−4.6	−2.7	−7.7	−1	−8.9	−9.5	−3.3	−8.4	−6.1	−2.5	−3.2	−12.2	−19.2	−6.9

– ... Cells with less than 30 respondents were not reported

Source: HLS19 Consortium

12.2.5 Use of digital resources

To assess the use of specific digital resources of information, respondents were also asked to state the number of days in a typical week they were using five specified selected digital resources: websites, social media, digital devices related to health care, mobile health apps, digital services of the respective national health system (for detailed wording of questions see Annex 12.4). Distributions vary by type of digital resources used, with on average higher use for websites, followed by social media, digital interaction with the health system, a digital device related to health or health care, a health app on a mobile phone, and other (Table 12.8). Distributions for individual countries are provided in the Annex 12.5 (Tables A 12.25 to A 12.30), as well as associations for these indicators of use of digital resources with Digital HL (Figure A 12.1 to A 12.6) as well as with the index on use of digital resources (Figure A 12.7). On average there is a slight increase of the mean score of HL-DIGI with an increase of each of the digital resources, but with differing and partly not so consistent patterns across individual countries.

Table 12.8:
Percentage distributions of responses to use of digital resources, for all countries (equally weighted)

Type of digital resources	Not relevant / DK / Refusal	Less than once per week	1-3 days per week	4-6 days per week	Once a day	More than once per day
Websites	26.9	47.7	15.1	3.2	3.2	3.9
Social Media including online forums	42.6	39.3	9.0	2.6	3.1	3.4
A digital device related to health or health care	49.8	24.7	7.1	4.6	7.0	6.8
Health app on your mobile phone	52.6	24.8	7.2	3.9	7.0	4.5
Digital interaction with your health system	48.3	43.9	4.7	1.2	1.1	0.9
Other	70.7	24.2	2.2	1.0	0.9	0.9

Source: HLS_{19} Consortium

A mean score was calculated to summarize the item set with a single score (see Section 12.2).

An interpretation of the use of digital resources and its association with other measures should consider that in the following countries all or part of the data was collected by means of a web-based questionnaire: Belgium, Switzerland, Czech Republic, Denmark, France, and Israel (cf. Section 12.1.5). The mean score is, on average, 1.4, and varies across countries from 1.2 (CH, DE) to 1.8 (IL), its SD on average 0.6 varies from 0.4 (CH, DE) to 0.8 (IL) (Table 12.9).

Table 12.9:
Means, standard deviations, medians, and quartiles of the average digital resources use score, for each country and for all countries (equally weighted)

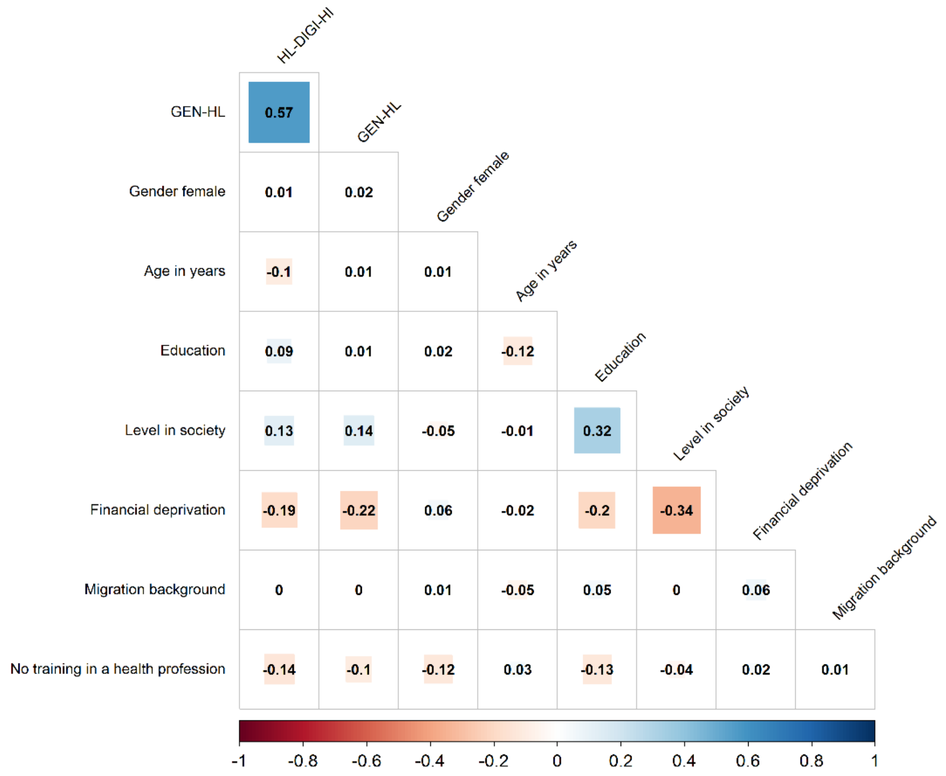
	Mean	SD	25th percentile	Median	75th percentile
AT	1.4	0.5	1.0	1.2	1.7
BE	1.4	0.7	1.0	1.2	1.6
CH	1.2	0.4	1.0	1.0	1.3
CZ	1.5	0.7	1.0	1.2	1.7
DE	1.2	0.4	1.0	1.0	1.2
DK	1.5	0.6	1.0	1.2	1.8
FR	1.3	0.6	1.0	1.0	1.3
HU	1.5	0.7	1.0	1.2	1.8
IE	1.4	0.5	1.0	1.3	1.7
IL	1.8	0.8	1.2	1.7	2.3
PT	1.3	0.5	1.0	1.0	1.4
SK	1.4	0.6	1.0	1.2	1.7
All	1.4	0.6	1.0	1.2	1.7

Source: HLS_{19} Consortium

12.2.6 Determinants and social gradient of Digital HL

There is a legacy in HL research demonstrating a social gradient for HL and the relative predictive value of selected potential determinants (see Chapter 6). In HLS_{19}, as in HLS-EU, five socio-demographic and socio-economic factors were investigated as possible determinants, and some additional variables (migration status, employment status, and long-term illnesses). For Digital HL, General HL was also considered as a possible determinant. But the most specific determinant for Digital HL, available in HLS_{19}, is use of digital resources. As a first step, Spearman correlation coefficients were estimated (Figure 12.5 and Annex 12.7 Table A 12.31), and bivariate associations of Digital HL with selected determinants were graphically explored (Annex 12. 8 Figures A 12.8 to A 12.10).

Figure 12.5:
Spearman correlations (ρ) among HL-DIGI, GEN-HL, and selected socio-demographic and socio-economic determinants, for all countries (equally weighted)



Source: HLS$_{19}$ Consortium

Highest correlated with HL-DIGI, was, on average, as already shown, General HL (ρ=0.57/0.58[10]), varying from ρ=0.45 (BE) to ρ=0.68 (IL)), next highest was financial deprivation (ρ=-0.19/-0.17); from -0.09 (BE) to -0.37 (SK)). Graphical presentation for individual countries is provided in Annex 12.8 Figure A 12.10 which shows a rather linear patterns for most countries, i.e., the more severe financial deprivation the lower HL-DIGI.

Over all countries (weighted equally), the Spearman correlation coefficient of HL-DIGI with the score for use of digital resources (see above chapter 12.2.4) is ρ=0.15 (ranging from 0.04 (BE) to 0.31 (DE)) (see Annex 12.7 Table A 12.31). A graphical presentation for individual countries is

10 Differences in values of Figure 12.5 and Table A 12.31 are due to different samples: NO is not included in Table A 12.31 as use of digital resources was not measured.

provided in Annex 12.6 Figure A 12.7. For most countries, HL-DIGI increases slightly with the score for use of digital resources, while some countries show an inconclusive pattern.

No training in a health profession correlated with HL-DIGI with ρ=-0.14 for all countries (equally weighted) (ranging from -0.03 (AT) to -0.18 (SK)). Level in society (ρ=0.13, ranging from 0 (AT) to 0.25 (SK)) was next strongly related, followed by age in years (ρ=-0.11; from +0.03 to -0.25). For all countries (weighted equally), HL-DIGI is slightly negatively correlated with age (ρ=-0.1, cf. Annex 12.8 Figure A 12.8). For most countries the mean HL-DIGI score decreases with older age group, but there are a few exceptions. Next with respect to the absolute size of the Spearman correlation coefficient was education (ρ=0.07, from -0.03 (CZ) to 0.31 (SK)). In most countries, the relationship between HL-DIGI and education is approximately linear in that the mean score of DIGI-HI increases with educational level (Annex 12.8 Figure A 12.9). The Spearman correlation coefficients of HL-DIGI with gender (ρ=0.01, varying from -0.07 (PT) to +0.07 (DK), and with migration background (ρ=0.01, from -0.06 (IL) to 0.09 (CH) were very low for all countries (equally weighted).

Regression model 1 with the five above mentioned social core determinants was investigated (Table 12.10). Equivalent models were also analyzed for General HL and the other specific HL measures in HLS_{19}. Three further regression models were investigated. Regression model 2 includes additionally the score for use of digital resources (Table 12.11), regression model 3 includes additionally the General HL score (Annex Table A 12.32), and regression model 4 includes additionally long-term illnesses/health problems (Annex 12.9 Table A 12.33).

Multivariable regression models for investigating determinants and social gradient of Digital HL (HL-DIGI)

For investigating a social gradient of Digital HL, as measured by HL-DIGI, the above described five social core determinants were used, which were also utilized in other chapters of this report (see Chapter 4) and in HLS-EU.

Model 1 (Table 12.10), with five social determinants, explains 6% of the variance in Digital HL for all countries weighted equally, varying from 2% (BE) to 23% (SK). The predictor with the, on average, highest standardized coefficient for all countries weighted equally was financial deprivation with ß=-0.15 (significant for eleven countries with a ß between -0.08 and -0.27), followed by age in years (ß=-0.13, significant for six countries, with a ß between -0.15 and -0.26), and level in society with ß=0.08 (significant for 10 countries, with ß between 0.05 and 0.13). Education and gender female have, on average, a low ß and are significant only for 5, respectively 3, countries. Thus, a social gradient for Digital HL was demonstrated, albeit with an inconsistent pattern across countries.

Model 2 (Table 12.11), additionally including a measure for use of digital resources, explains 7% (varying between 2% (BE) and 24% (SK)), of the variance in Digital HL in all countries (equally weighted). This is just one percent more of the variance of digital HL than model 1. Again, financial deprivation is the predictor with the highest absolute standardized regression coefficient (ß=-0.14) for all countries (equally weighted), followed by age in years (ß=-0.12), and use of digital resources (ß= 0.11, significant for ten countries, with ß ranging from 0.06 to 0.22). The regression coefficient for level in society (ß=0.08) is significant for eight countries, education for just 4 countries, and gender female for one country. In summary, use of digital resources is a relevant predictor of Digital HL for almost all countries and partly mediates the effects of the five social predictors, whose direct effects are somewhat reduced, by including it into the model.

Model 3 (Annex 12.9 Table A 12.32) includes the General HL score in addition to the five social predictors. General HL increases, not unexpectantly, the explained variance of Digital HL considerably. R^2 is 33% for all countries weighted equally, varying from 21% (BE) to 46% (IL). The regression coefficient for General HL (ß=051 for all countries) is significant for all countries weighted equally, varying between ß=0.44 (AT, BE) and ß=0.67 (IL). In Model 3, General HL is the strongest predictor, followed by age in years (ß=-0.13, significant for 13 countries with ß between -0.04 and -0.2). The effects of financial deprivation (ß=-0.06 for all countries weighted equally, significant for four countries between ß -0.06 and -0.15), level of society (ß=0.03 for all countries weighted equally, significant for two countries with ß between 0.05 and 0.07) and female gender (ß=0 for all countries weighted equally, significant for just two countries) are considerably smaller. The regression coefficient of education (ß=0.06 for all countries weighted equally, significant for 7 countries, with ß between 0.05 and 0.17) is larger. Thus, General HL is an important predictor of Digital HL, partly mediating effects of the five social determinants.

Regression model 4 (Annex 12.9 Table A 12.33) includes long-term illnesses/health problems in addition to the five social determinants but the explained variance of Digital HL is comparable to model 1 (R^2=0.06 for all countries weighted equally, varying between 2% (BE) and 22% (SK)). In this model, long term illness is the fourth strongest predictor (ß=-0.05 for all countries weighted equally, significant for two countries with ß between -0.10 and -0.16).

Table 12.10:
Model 1: Multivariable linear regression models of HL-DIGI by <u>five social determinants</u> (standardized coefficients (β) and R^2), for each country and for all countries (equally weighted)

	AT	BE	CH	CZ	DE	DK	FR	HU	IE	IL	NO	PT	SK	All
Gender female	0.01	0.02	0	0.02	0.03	**0.07**	0	0.04	**0.04**	0.04	**0.08**	−0.07	0.02	**0.03**
Age in years	**−0.20**	−0.05	**−0.18**	−0.03	**−0.26**	**−0.17**	**−0.15**	−0.06	0	−0.04	−0.02	−0.08	**−0.16**	**−0.13**
Education	0.05	0.01	0.02	−0.07	**0.16**	**0.14**	−0.01	0.01	**0.07**	0.01	**0.11**	0.04	**0.18**	**0.03**
Level in society	0.01	**0.12**	**0.09**	**0.10**	**0.13**	**0.10**	**0.11**	−0.01	**0.05**	**0.13**	**0.06**	−0.03	**0.11**	**0.08**
Financial deprivation	**−0.15**	−0.07	**−0.10**	**−0.16**	**−0.08**	**−0.09**	−0.06	**−0.27**	**−0.13**	**−0.14**	**−0.09**	**−0.17**	**−0.27**	**−0.15**
R^2	0.07	0.02	0.06	0.05	0.14	0.10	0.04	0.08	0.04	0.05	0.04	0.04	0.23	0.06
Valid Count	2253	988	1901	1249	1735	3537	1000	892	3516	1149	2272	760	1624	
Total Count	2967	1000	2502	1599	2143	3602	1000	1195	4487	1315	2855	1247	2145	

Coefficients with p-values lower than 0.01 in bold.
Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of −0.005 to +0.005.
HL-DIGI score: from 0=minimal HL to 100=maximal HL.
Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

Source: HLS_{19} Consortium

Table 12.11:
Model 2: Multivariable linear regression models of HL-DIGI by five social determinants and use of digital resources (standardized coefficients (β) and R^2), for each country and for all countries (equally weighted)

	AT	BE	CH	CZ	DE	DK	FR	HU	IE	IL	PT	SK	All
Use of digital resources	**0.07**	0.06	**0.08**	**0.08**	**0.22**	**0.06**	**0.09**	−0.03	**0.06**	**0.16**	**0.14**	**0.10**	**0.11**
Gender female	0.01	0.02	−0.01	0.02	0.02	**0.06**	0.01	0.03	0.04	0.04	−0.06	0.02	**0.02**
Age in years	**−0.19**	−0.04	**−0.16**	−0.02	**−0.22**	**−0.16**	**−0.13**	−0.06	0.01	−0.02	−0.07	**−0.14**	**−0.12**
Education	0.04	0.01	0.01	−0.06	**0.15**	**0.14**	−0.01	0.02	**0.07**	0	0.03	**0.17**	**0.02**
Level in society	0.01	**0.12**	**0.09**	**0.09**	**0.09**	**0.10**	0.09	0	**0.04**	**0.11**	−0.04	**0.10**	**0.08**
Financial deprivation	**−0.15**	−0.07	**−0.11**	**−0.17**	**−0.08**	**−0.1**	−0.07	**−0.26**	**−0.13**	**−0.15**	**−0.16**	**−0.27**	**−0.14**
R^2	0.07	0.02	0.06	0.05	0.19	0.1	0.05	0.08	0.04	0.07	0.06	0.24	0.07
Valid Count	2215	988	1899	1244	1698	3509	1000	871	3509	1139	750	1621	
Total Count	2967	1000	2502	1599	2143	3602	1000	1195	4487	1315	1247	2145	

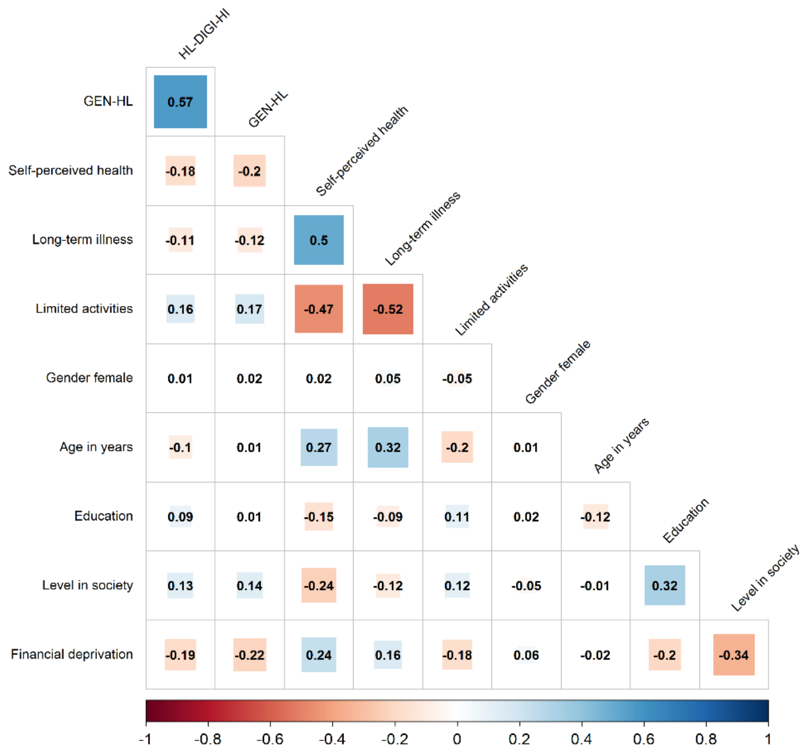
Coefficients with p-values lower than 0.01 in bold.
Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of −0.005 to +0.005.
HL-DIGI score: from 0=minimal HL to 100=maximal HL.
Use of digital resources: from 0=minimal to 100=maximal use of digital resources
Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

Source: HLS_{19} Consortium

12.2.7 Health related consequences of Digital HL

For demonstrating the relevance of HL for health in HLS_{19}, as in HLS-EU and earlier studies, indicators for lifestyle, personal health and use of health care services were used (see Chapters 7-9). For Digital HL, only indicators for health and utilization of health care services were hypothesized. Concerning indicators for personal health, the strongest absolute Spearman correlation coefficient with Digital HL was found for self-perceived health (ρ=-0.18 for all countries weighted equally, on average, Figure 12.6) with ρ varying between -0.10 (IE) and -0.28 (DE) (see Annex 12.10 Table A 12.34) and for limitation by long-term illnesses/health problems (ρ=0.18 for all countries weighted equally). The Spearman correlation coefficient with long-term illnesses/health problems (ρ=-0.11 for all countries weighted equally) is slightly smaller. Only the association with self-perceived health was further investigated by regression models to demonstrate a potential direct effect of Digital HL (see Table 12.12.)

Figure 12.6: Spearman correlations (ρ) among indicators of health status, with HL-DIGI, GEN-HL, and selected socio-demographic and socio-economic determinants, for all countries (equally weighted)



Source: HLS_{19} Consortium

To determine if Digital HL has an additional effect on self-perceived health besides social determinants, a regression analysis was performed with Digital HL, gender, age, education, level in society and financial deprivation as predictor variables and self-perceived health as the outcome variable (Table 12.12), This model explains 15% of the variance of self-perceived health for all countries weighted equally (R^2 varying from 10% (IE) to 26% (SK)). Age (average ß=0.24, ranging from 0.07 to 0.38, significant for all countries except BE) and self-perceived level in society (average ß=-.17, ranging from -0.29 to -0.09, significant for all countries) are among the strongest predictors for all countries weighted equally. Digital HL significantly contributes to the regression in nine out of the thirteen countries (average ß=-0.10, ranging from -0.05 to -0.14).

A second regression model (Annex Table A 12.37) with Digital HL, and General HL (which is correlated considerably with Digital HL and somewhat with self-perceived health - Figure 12.6), and the five social determinants as predictor variables and self-perceived health as outcome variable, was analyzed, to find out, if Digital HL has an additional effect on self-perceived health, besides the already known effect of General HL (cf. Chapter 8.3). This model explains 17% of the variance of self-perceived health for all countries weighted equally (R^2 varying from 11% (IE) to 26% (SK)). Self-perceived level in society (ß=-0.16, ranging from -0.27 to -0.08) and General HL (ß=-0.15, significant for nine countries with ß between -0.09 and -0.23) are among the strongest predictors, for all countries weighted equally. For most countries, Digital HL (ß=-0.01, significant only for two countries with ß ranging from -0.08 to -0.09) does not show an additional effect to General HL on self-perceived health.

Table 12.12:

Model 1: Multivariable linear regression models of <u>self-perceived health</u>, by HL-DIGI score and five core social determinants (standardized coefficients (β) and R^2), for each country and for all countries (equally weighted)

	AT	BE	CH	CZ	DE	DK	FR	HU	IE	IL	NO	PT	SK	All
HL-DIGI	**−0.11**	−0.06	**−0.08**	−0.06	**−0.14**	**−0.11**	**−0.12**	−0.03	**−0.05**	**−0.1**	**−0.07**	−0.08	**−0.09**	**−0.1**
Gender female	−0.03	0.04	−0.03	−0.02	−0.03	**−0.05**	−0.01	0.05	−0.03	−0.02	0.03	**0.09**	0.02	−0.01
Age in years	**0.25**	0.07	**0.21**	**0.34**	**0.38**	**0.08**	**0.19**	**0.3**	**0.11**	**0.29**	**0.16**	**0.3**	**0.38**	**0.24**
Education	**−0.06**	−0.08	−0.04	**−0.11**	−0.03	−0.03	0.01	−0.05	**−0.08**	0.02	**−0.09**	−0.06	−0.03	**−0.03**
Level in society	**−0.1**	**−0.29**	**−0.18**	**−0.15**	**−0.09**	**−0.15**	**−0.23**	**−0.14**	**−0.12**	**−0.17**	**−0.2**	**−0.13**	**−0.1**	**−0.17**
Financial deprivation	**0.15**	−0.04	**0.16**	**0.16**	**0.15**	**0.2**	**0.13**	**0.2**	**0.2**	**0.13**	**0.16**	**0.17**	**0.14**	**0.14**
R^2	0.14	0.11	0.14	0.23	0.25	0.12	0.16	0.22	0.1	0.16	0.12	0.23	0.26	0.15
Valid Count	2251	988	1900	1249	1733	3535	1000	892	3516	1147	2271	760	1621	
Total Count	2967	1000	2502	1599	2143	3602	1000	1195	4487	1315	2855	1247	2145	

Coefficients with p-values lower than 0.01 in bold.

Due to rounding the numbers to two significant decimals. zeros may represent a value in the range of −0.005 to +0.005.

Self-perceived health: from very good (1) to very bad (5).

HL-DIGI score: from 0=minimal HL to 100=maximal HL.

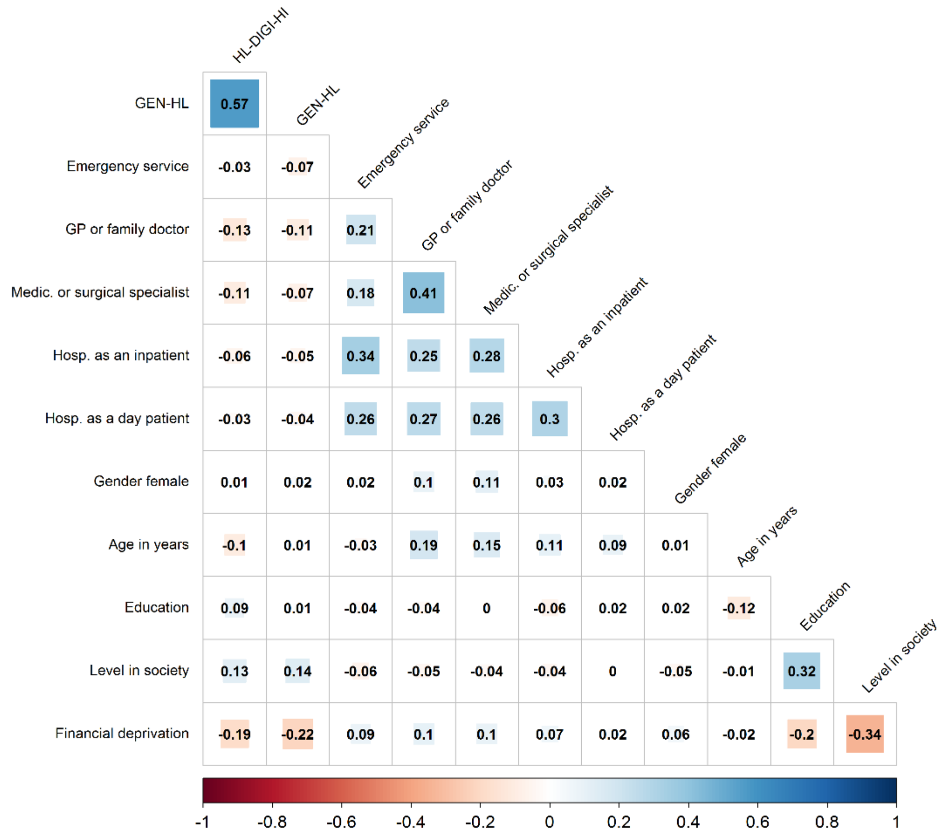
Education by 9 ISCED levels. from 0 (lowest) to 8 (highest level).

Level in society from 1=lowest level to 10=highest level in society.

Financial deprivation: 4 categories. from no deprivation (0) to severe deprivation (100).

Source: HLS_{19} Consortium

Figure 12.7:
Spearman correlations (ρ) among indicators of health care utilization, with HL-DIGI, GEN-HL, and selected socio-demographic and socio-economic determinants, for all countries measuring digital HL (equally weighted)



Source: HLS_{19} Consortium

For indicators of use of healthcare services, the highest correlations of HL-DIGI were found for utilization of GP/family doctors (ρ=-0.13, varying from -0.04 (BE, CZ) to -0.18 (DE, SK), and of medical and surgical specialists (ρ=-0.11, varying from 0 (BE) to -0.12 (PT, SK) (Figure 12.7). For the Spearman correlation coefficients by country see Annex 12.10 Table A 12.35 respectively A 12.36. Therefore, just the association with GP/family doctors (Table 12.13), was further investigated by regression models.

Regression model 1 for Digital HL, gender, age, education, level in society and financial deprivation as predictors for the number of contacts with GPs or family doctors (Table 12.13) explains on average 6% of the variance (R^2 varying from 4% (DK, IL) to 14% (DE)). Age (average ß=018, significant for eleven countries with ß between 0.04 and 0.30), and female gender (average ß=0.09, significant for ten countries, with ß between 0 and 0.19) are the most important predictors over all countries weighted equally. On par with financial deprivation (average ß=0.08, significant for ten countries with ß between -0.01 and 0.17), Digital HL is the third most important predictor of contacts with GPs or family doctors (average ß=-0.08, significant for seven countries with ß between -0.01 and -0.09).

Regression model 2 for the number of <u>contacts with GPs or family doctors</u>, with also General HL included as a predictor (Annex Table A 12.38), explains on average 7% of the variance (R^2 varying from 4% (DK, IL) to 14% (DE)). After age in years (ß=0.18, significant for eleven countries with ß between 0.08 and 0.30), gender female (ß=0.10, significant for ten countries, with ß between 0.07 and 0.19), and financial deprivation (ß=0.08, significant for ten countries with ß between 0.06 and 0.17), General HL (ß=-0.07) was just the fourth important predictor over all countries weighted equally ($p \leq 0.01$significant only for two countries, ranging from ß=-0.07 to -0.08). Digital HL was the fifth important predictor over all countries weighted equally (ß=-0.05, significant for three countries with ß between -0.07 and -0.11).

Table 12.13:
Model 1: Multivariable linear regression models of utilization of GPs/family doctors by HL-DIGI and five core social determinants (standardized β coefficients and R^2), for each country and for all countries (equally weighted)

	AT	BE	CH	CZ	DE	DK	FR	HU	IE	IL	NO	PT	SK	All
HL-DIGI	**-0.1**	-0.02	-0.05	-0.01	**-0.08**	**-0.07**	-0.06	**-0.09**	**-0.05**	-0.04	**-0.06**	-0.06	**-0.09**	**-0.08**
Gender female	**0.09**	**0.08**	0.03	0	**0.09**	**0.1**	0.07	**0.14**	**0.17**	**0.09**	**0.16**	**0.19**	**0.07**	**0.09**
Age in years	**0.22**	**0.16**	**0.18**	**0.17**	**0.3**	**0.07**	**0.17**	**0.25**	**0.11**	0.04	0.05	**0.12**	**0.22**	**0.18**
Education	-0.01	**-0.18**	-0.03	**-0.09**	-0.02	-0.02	-0.01	-0.03	-0.02	-0.07	**-0.09**	-0.03	-0.03	**-0.03**
Level in society	0.05	-0.06	**-0.08**	-0.04	-0.05	**-0.09**	-0.02	0	**-0.05**	0.02	0	0	0.03	-0.01
Financial deprivation	**0.1**	-0.01	**0.07**	**0.1**	**0.09**	**0.06**	**0.12**	0.06	**0.1**	**0.14**	**0.09**	0.07	**0.17**	**0.08**
R^2	0.1	0.09	0.06	0.06	0.14	0.04	0.06	0.11	0.06	0.04	0.05	0.07	0.13	0.06
Valid Count	2209	981	1901	1233	1689	3526	1000	891	3503	1149	2258	760	1615	
Total Count	2967	1000	2502	1599	2143	3602	1000	1195	4487	1315	2855	1247	2145	

Coefficients with p-values lower than 0.01 in bold.
Due to rounding the numbers to two significant decimals. zeros may represent a value in the range of -0.005 to +0.005.
Utilization of GPs/family doctors: number of contacts in the last 12 months, from 0 to 6 or more contacts.
HL-DIGI score: from 0=minimal HL to 100=maximal HL.
Education by 9 ISCED levels. from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories. from no deprivation (0) to severe deprivation (100).

Source: HLS_{19} Consortium

12.3 Summary, Discussion and Conclusions

For measuring Digital HL in general adult populations, a newly developed scale for Digital HL and additionally few specific correlates were introduced and examined in a sample of nearly 29,000 participants in 13 countries. Based on the conceptual model, definition and matrix of the HLS-EU consortium, HLS_{19}-DIGI measures the ability to find, understand, evaluate, and apply digitally available health related information. Two items aimed at measuring difficulty of interaction with digital sources. Also, frequency of using different kinds of digital resources was measured as a potential determinant.

The HLS_{19}-DIGI scale of eight items is sufficiently unidimensional. The thresholds, and thus the response categories, were ordered and well-functioning. One item tends to discriminate somewhat poorly across most countries and some items display DIF for country or language, which could limit international comparisons. In a later study, it should be investigated whether changes to items like, e.g., 6 “to visit different websites to check whether they provide similar information about a topic” and 5 “to judge whether the information is offered with commercial interests” could improve the fit. The reliability of the scale, based on Cronbach’s alpha, is sufficiently high, with values from 0.77–0.87. In several countries, the HLS_{19}-DIGI score displays a ceiling effect, with more than 25% scoring the highest value. The scores on HLS_{19}-DIGI are correlated with General HL (r=0.53), suggesting that both scales measure parts of the same constructs, but are independent enough to be treated as different scales. Concerning that, countries did not differ much. The same holds true for Navigational HL (r=0.55).

The two items measuring difficulty of interacting with digital resources are highly correlated, and, in some countries, do not differentiate well, suggesting that items should be changed. The two measures are, on average, correlated (r=0.48), but this differs considerably between countries.

As far as frequency of use of digital sources of information is concerned, the response categories should be further developed, as most participants did not use the digital sources within the last week and by this did not differentiate participants.

On average, 8%, across countries from 2% to 18%, of the tasks of the HL-DIGI scale were answered as “very difficult” and, on average, further 25%, from 20% to 40%, as “difficult”. Thus, depending on country, from 22% to 58% of the tasks were experienced either as difficult or very difficult. Most difficult was the task 5 “to judge whether the information is offered with commercial interests” and 4 “to judge whether information is reliable”. Task 1 “to use the proper words or search query to find the information you are looking for” or task 6 “to visit different websites to check whether they provide similar information about a topic” were judged by fewer respondents to be difficult.

In a model of five social determinants, a social gradient for HLS_{19}-DIGI was demonstrated for all countries, but to a considerable different degree. Strongest social predictors of HLS_{19}-DIGI, on average, were financial deprivation, age, and level in society, although they were not consistently significant with $p \leq 0.01$ in all countries. Education and gender were significant just in few countries. In a model with additionally General HL included, it was shown to be a very strong predictor of Digital HL for all countries, in a model with use of digital resources additionally included, it was a rather strong predictor for most countries. Concerning vulnerable subpopulations, respondents older than 75 years, people who perceived their health as bad or very bad, or with low education, were the most vulnerable concerning Digital HL.

As far as potential consequences of Digital HL are concerned, it was shown that there were, on average, relevant correlations with self-perceived health, limitations by long-term illnesses/health problems. For self-perceived health in a model with the five social determinants, HLS_{19}-DIGI had a significant potential direct effect in 9 out of 13 countries, but just for two countries, when General HL was additionally included, which had a significant direct effect for nine countries. For health care utilization, correlations were highest, on average, for GP/family doctors, and medical or surgical specialists. In regression models for GPs/family doctors, including the five social determinants, a potential direct effect of HLS_{19}-DIGI was found for seven countries, but when General HL was also included as a predictor, it had an effect only for three countries.

It should also be acknowledged that the results and conclusions do have limitations, mainly due to differences in the data collection methods in HLS_{19} between countries, and within countries. The method for data gathering in several countries (IL, BE, FR, CZ, DK) was (partly) through web-based surveys which may possibly have biased the results in the direction of over-reporting for Digital HL for these countries.

In conclusion, a compact new measure HLS_{19}-DIGI has been validated for 12 national languages (Arabic, Czech, Danish, Dutch, French, German, Hebrew, Hungarian, Italian, Norwegian, Portuguese, Russian, and Slovak) in 13 countries, with acceptable psychometric properties, but some potential for improvement. The relevance of Digital HL was demonstrated by considerable proportions of general adult populations having limited Digital HL, by a social gradient for Digital HL and associations of Digital HL with indicators of health status and use of health services. To note, difficult tasks for dealing with digital health-related information, and sub-populations with higher proportions of limited HL were identified for prioritising health policy interventions.

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13 Vaccination Health Literacy

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13.1 Background and instrument

13.1.1 Overview of the relevance, existing research, and measures of Vaccination Health Literacy

Relevance

As a strategy of public health policy, immunization has proven to be effective in preventing disease, adverse health outcomes, and death (Andre et al. 2008; Ratzan 2011). The World Health Organization (WHO) estimates that vaccinations save two to three million lives worldwide each year (WHO 2017). Furthermore, high vaccination coverage rates contribute to the eradication of communicable diseases (Centers for Disease Control and Prevention 1999).

Ensuring high vaccination coverage rates requires a high level of public and individual confidence and trust in vaccination programs and the actors initiating these programs. However, research has shown that confidence in vaccination has declined worldwide, leading to increased delays in or refusal of vaccination despite the availability of vaccine services (WHO 2017). This contributes to declining vaccination rates and to the re-emergence of communicable diseases, as the recent measles outbreaks in Europe have revealed (WHO 2018).

A survey conducted by the Vaccine Confidence Project in 67 countries in 2016 (Larson et al. 2016) shows that the population in the WHO European Region has the lowest confidence in the safety and effectiveness of vaccines compared to other regions of the world. This result has been confirmed by a more recent comparison of 149 countries (de Figueiredo et al. 2020b). Vaccine hesitancy is therefore a pressing public health issue, especially in Europe, and poses an increasing challenge to health authorities, as the Corona pandemic is illustrating (Griebler et al. 2021). On top of that, a Norwegian HL survey among five immigrant populations suggested that immigrants are at even higher risk of vaccine hesitancy. Among immigrants, lower economic status and language proficiency are associated with difficulties in dealing with and processing information about vaccines (Le et al. 2021). In this context, an EU-wide study has indicated that public confidence in vaccination correlates significantly with doctors' confidence in vaccines: In countries where doctors have a higher level of confidence in vaccinations, the population's trust in vaccinations is also higher (de Figueiredo et al. 2020). In addition, a systems approach to vaccines in individual countries has shown to facilitate high vaccination rates (Levin-Zamir 2020).

Credible and tailored information coupled with high HL among citizens could be a way out of the "vaccination crisis" to regain people's confidence in vaccinations. However, information on vaccination is often very complex, not always easy to understand, and difficult to access. In addition, individuals nowadays are confronted with a wealth of biased and one-sided information that is disseminated mainly through digital media (Lorini et al. 2018; Rowlands 2014). Although these channels can also be used by vaccination advocates, the internet and social media mainly provide a stage for vaccination opponents to spread misinformation, disinformation, and skepticism (Dubé et al. 2013; Puri et al. 2020). A high level of population HL is therefore a prerequisite for assessing the trustworthiness and quality of information as well as for dealing competently with false and misleading information (Lorini et al. 2018; Wang et al. 2018).

Therefore, a specific optional package (OP) on Vaccination Health Literacy and relevant explanatory variables was included in the HLS_{19} study, even before the Covid-19 pandemic.

Definition

As no adequate definition of Vaccination HL was found in the literature, the definition of General HL was adopted and applied to vaccination. Following the HLS-EU Consortium's definition (Sørensen et al. 2012), Vaccination HL may refer to individuals' knowledge, motivation, and skills to find, understand, and evaluate immunization-related information in order to make adequate immunization decisions (see also Zhang et al. 2020). Understood as a relational concept (Parker, Ruth 2009), HL does not only emerge from personal skills and abilities but also in conjunction with the availability, comprehensibility, accessibility and practicability of health-related information, communications, and offers, and this also applies to Vaccination HL (Ratzan 2011).

For a better understanding of the concept behind Vaccination HL, it is necessary to distinguish Vaccination HL from other relevant determinants of vaccination behavior. Research on determinants of (non-)vaccination has shown that decisions for or against immunization are driven by individual and collective experiences and beliefs, knowledge, situational/contextual conditions (vaccination information, doctors' attitudes and knowledge, anti- or pro-vaccination lobbies, etc.), and the vaccination itself (Dubé et al. 2013; Larson et al. 2015; MacDonald 2015; Thomson et al. 2016). Although vaccination hesitancy proves to be both context- and vaccine-specific, some general factors have been identified that influence the decision (not) to get vaccinated. The most important of these factors have been summarized in the "7Cs model" by Geiger et al. (2021):

» Confidence – (lack of) trust in the effectiveness and safety of vaccines, in the healthcare providers who deliver them, and in committees/individuals who recommend and approve vaccines,
» Complacency – (low) awareness of the risks of vaccine-preventable diseases and of the need for vaccination,
» Constraints – (low) structural or psychological barriers that make vaccination difficult (availability, affordability, accessibility, comprehensibility of information, effort, etc.),
» Calculation – the degree to which the personal costs and benefits of vaccination are weighed up,
» Collective responsibility – (low) sense of responsibility towards the community to contribute to the reduction in contagious and infectious diseases by getting vaccinated to protect others (e.g., children or sick people),
» Compliance – the degree to which social monitoring and the sanctioning of people who are not vaccinated are supported,
» Conspiracy – the degree of belief in conspiracy theories and fake news about vaccinations.

The 7Cs model, which emphasizes individual determinants, integrates various categorizations of vaccination determinants, such as the 5As model, the 3Cs model, the 5Cs model, and the SAGE model on determinants of vaccine hesitancy (Betsch et al. 2018; Dubé et al. 2013; Larson et al. 2015; Thomson et al. 2016). HL and Vaccination HL seem to relate to the 7Cs model and should therefore be investigated in conjunction with its constituents.

A brief literature review

A recent systematic review (Lorini et al. 2018) identified nine studies that examine the relationship between HL and vaccination behavior and attitudes towards vaccination. The nine studies cover the elderly, adults, and the parents of young children; vaccination against hepatitis B, diphtheria-tetanus-pertussis, mumps-measles-rubella, polio, influenza, pneumococcus, rotavirus, and human papillomavirus (HPV); and use different instruments to assess participants' HL. Six of the nine studies assessed HL using measures of functional HL (self-reported or performance-based: HL scale of the NAAL, NVS, Chew's SBSQ, S-TOFHLA). Three of the studies created and used an ad-hoc instrument for vaccine-related HL but did not report on the psychometric properties of the measure (Aharon et al. 2017; Johri et al. 2015; Lee et al. 2015). One study included an instrument for functional Vaccination HL (Johri et al. 2015).

The nine studies reported partly contradictory results. However, the results indicated a positive correlation between HL or Vaccination HL and vaccination attitudes and behavior. Higher HL was associated with a more positive attitude towards vaccination and a higher uptake of vaccinations. Additional studies underline this result (Albright/Allen 2018; Castro-Sánchez et al. 2018; Griebler et al. 2021; Kitur et al. 2021; Montagni et al. 2021; Wisk et al. 2014; Zhang et al. 2020).

HL and childhood vaccinations

In an Israeli study, a negative association appeared between parents' HL and their willingness to vaccinate their children (Aharon et al. 2017), which means that parents with higher functional, communicative, and critical HL have a higher risk of refusing to vaccinate their children. This attitude was confirmed by a Spanish study (not included in Lorini et al. 2018), showing that women with high HL were more likely to decline immunization against influenza for their children (Castro-Sánchez et al. 2018).

An experimental study in the Netherlands on parents' preferences for vaccinating their children against rotavirus (Veldwijk et al. 2015) reported that parents with high HL are more concerned about the effectiveness of the vaccine and the incidence of possible severe side effects, while less proficient parents are more often interested in the duration of vaccine protection. Most parents were willing to vaccinate their children against rotavirus if the vaccination is included in the national vaccination program. However, less health literate parents may choose to vaccinate their children even if the vaccination is only available on the open market.

A positive association for mothers' HL and their children's full diphtheria-tetanus-pertussis immunization was observed in an Indian study (Johri et al. 2015), while an American cohort study found no association between mothers' HL and their children's general vaccination status (Pati et al. 2011).

HL and vaccination among young people

Many young people are unvaccinated, even though they are particularly at risk of getting infectious diseases. In a study from the USA (not included in Lorini et al. 2018), greater knowledge of HPV was associated with HL while there was no association between HL and vaccination status in relation to HPV among college students (Albright/Allen 2018). The HPV and its ease of sexual transmission is the reason why it is highly prevalent in the young, sexually active population, for instance in a large proportion of female adolescents/young people. However, another study from the USA on disparities in HPV vaccine awareness among parents of preadolescents and adolescents (also not included in Lorini et al. 2018) revealed that only parents of adolescents who are characterized with factors associated with higher HL are more likely to be aware of HPV vaccines (Wisk et al. 2014).

Studying college-aged women, Lee et al. (2015) observed a positive association between HL and their willingness to have an HPV vaccination. A similar conclusion was reached by another American study (not included in Lorini et al. 2018) showing a positive association between HL and HPV vaccine acceptance in university students (Kitur et al. 2021).

In a review study from Canada about HPV vaccine uptake among Canadian youth, lack of knowledge about vaccines as well as attitudes that are affected by disinformation or not supported by relevant scientific evidence were found to be among the barriers to uptake of the HPV vaccination. (Scott/Batty 2016).

HL and vaccination among adults and the elderly

Three American studies looked at the relationship between HL and vaccination in the elderly. White et al. (2008) observed that the correlation between HL and influenza vaccination uptake changed from negative to positive as age increased and found no association between HL and pneumonia vaccination uptake in adults 65 and older. Studying elderly people, Bennett et al. (2009) confirmed a positive association between HL and the willingness to have an influenza vaccination. According to an Austrian study (not included in Lorini et al. 2018), higher vaccination-related HL was associated with a greater willingness to be vaccinated against Covid-19 (Griebler et al. 2021). This was confirmed by a French study (also not included in Lorini et al. 2018) showing that acceptance of a Covid-19 vaccination was associated with a better ability to detect fake news and higher HL (Montagni et al. 2021). A population-based HL survey from Norway suggested that people associated with low economic status, low oral and written language proficiency, and an immigrant background are less likely to access vaccine information or understand what vaccines they need and why (Le et al. 2021).

HL and vaccination-related HL

A study conducted in Hong Kong among people aged 65 or over (not included in Lorini et al. 2018) observed a significant correlation between HL and their definition of vaccination-related HL (Zhang et al. 2020). HL and Vaccination HL were assessed with the Chinese version of the HLS-EU-Q47

(HLS-Asia-Q). A negative association for vaccination-related HL and age was indicated (the older the person, the lower their HL) and so was the association for vaccination-related HL and the number of chronic health complaints and diseases (the more health complaints/diseases, the lower the HL).

Conclusion

Overall, it seems that "relevant" vaccinations are positively correlated with HL (influenza/old people, HPV/young females). Perhaps people with high HL identify vaccinations that are relevant to them and "skip" others.

13.1.2 Overall objective and research questions

The overall objective was to provide a jointly developed and validated, internationally applicable measure of and data on Vaccination HL in different countries, contributing to an understanding of the role of HL in the debate on vaccination hesitancy and supporting relevant policy action.

The following research questions were formulated:

1. To what extent do the four items on Vaccination HL empirically constitute a unidimensional scale with sufficient internal consistency that measures a different latent trait to the HLS_{19}-Q12 for General HL?
2. How are the scores of the individual Vaccination HL items and the composite Vaccination HL score distributed in general adult populations?
3. How is the Vaccination HL score distributed in different vulnerable or disadvantaged subpopulations?
4. What are the most influential determinants of Vaccination HL based on the socio-demographic and socio-economic variables collected in the HLS_{19}?
5. How are the scores on Vaccination HL related to other relevant specific determinants of vaccination behavior (vaccination confidence, knowledge about the risks of vaccination, and perceived risks of developing a disease if not vaccinated)?
6. How is Vaccination HL related to vaccination behavior and how does Vaccination HL influence vaccination behavior, controlling for General HL and other determinants of reported vaccination behavior (vaccination confidence, knowledge about the risks of vaccination, and perceived risks of developing a disease if not vaccinated)?

13.1.3 Measuring vaccination-related HL and vaccination-specific background variables in the HLS_{19}

With no specific definition or conceptual model of Vaccination HL, there are currently very few survey instruments available to assess context-independent, overall Vaccination HL, i.e., not focused on a particular disease. Only the Vaccine Health Literacy Scale (Aharon et al. 2017), which captures Nutbeam (2000) definition of HL, assesses context-independent Vaccination HL, and the scale has been field tested in Italy (Biasio et al. 2020).

In another study, Zhang et al. (2020) selected the four vaccination-related items (items 19, 22, 26, and 29) from the 15 items in the disease prevention item bundle of the HLS-EU-Q47 (Sørensen et al. 2013), and assessed Vaccination HL in line with the current understanding of HL by the HLS-EU Consortium (Sørensen et al. 2012). However, one of these four items is context dependent (item 29 refers to vaccination against influenza), and one item refers to both vaccination and health screenings (item 19). Therefore, the HLS_{19} study and a related Austrian study on SARS-CoV-2- and Covid-19-related HL (Griebler et al. 2021) used a revised version of the latter item by discarding the screening facet. The four Vaccination HL items are aligned with the definition of Vaccination HL by measuring the process dimensions of finding, understanding, judging, and applying vaccination information to make better immunization decisions and were already fully aligned with the HLS_{19} methodology by asking "how easy or difficult it is" to perform tasks related to vaccination information. Data were collected using the HLS_{19} 4-point rating scale "very easy" – "easy" – "difficult" – very difficult". To validate the measure and to analyze the potential consequences of Vaccination HL, additional specific correlates were assessed.

In addition to the four Vaccination HL items, the HLS_{19} optional package on Vaccination HL included

» one item on personal vaccination behavior during the previous five-year period,
» four items referring to personal confidence in vaccinations (Confidence),
» three items on myths about the possible risks of getting vaccinated (Calculation/Conspiracy),
» one item on the risk of getting a disease for which a vaccine exists (Complacency).

While the latter three aspects represent other relevant specific vaccination determinants, vaccination behavior is the main expected study outcome. A more detailed description of these measurement instruments can be found in Annex 13 (Tables A 13.1 to A 13.14).

In line with previous EU surveys (de Figueiredo et al. 2020; Larson et al. 2018), the "Confidence in vaccination" aspect was assessed by using the shortened 4-item version of the Vaccine Confidence Index (Larson et al. 2016; Larson et al. 2015), which measures confidence in vaccinations in terms of their importance, safety, and effectiveness. The items ask respondents to rate how strongly they agree ("strongly agree" – "agree" – "disagree" – "strongly disagree") that vaccinations are important to protect themselves and their children, that vaccinations are safe, that vaccinations are effective, and that vaccinations are compatible with their religious beliefs. In the HLS_{19}, this item block was supplemented by an additional item on the importance of vaccinations (to prevent the spread of diseases). In the HLS_{19} the item asking about the compatibility of vaccinations with religious convictions was discarded from the "confidence" item set, since it does not elicit confidence in vaccinations but reflects religious attitudes. This has also been confirmed by factor analyses. The four items used were combined into an index reflecting the respondents' confidence in vaccinations.

The one item on vaccination behavior ("Have you, your children, or has someone in your family had any vaccinations in the last five years?") and the three items on perceived vaccination risks ("Is it true or false that vaccines overload and weaken the immune system / can cause the diseases against which they protect / often produce serious side effects) were taken from the Eurobarometer survey “Europeans’ attitudes towards vaccination” (EU 2019). The response options for the “vaccination behavior” item were adapted slightly, changing the response categories from “yes, yourself, yes, your children, yes, someone else, and no” to “yes” and “no”, and the items on vaccination risks were combined into an index that reflects the respondents’ knowledge about those risks.

The item on disease risk was taken from a Swiss survey on vaccination (Schulz et al. 2019). In the HLS_{19}, the risk of disease was not asked in connection with specific diseases but only overall.

The HLS_{19} Working Group and Optional Package on Vaccination HL was initiated and developed by three HLS_{19} countries (AT, BE, and IE). The results on the distribution of the individual items can be found in Annex 13 (Tables A 13.1 to A 13.14).

13.1.4 Countries implementing the optional package on vaccination-related HL in their HLS_{19} national assessment

Seven countries implemented the complete optional package on Vaccination HL, and four additional countries collected data on at least the four Vaccination HL items and general background variables. Hence, 11 of the 17 countries participating in the HLS_{19} collected data on the four Vaccination HL items. In total, data on Vaccination HL are available for just over 25,000 respondents in Europe.

Table 13.1 below reports the data collection method(s) or “mode(s)” used by each country, such as computer-assisted telephone interviewing (CATI), computer-assisted web interviewing (CAWI), and computer/paper-assisted personal interviewing (PAPI/CAPI), the period of the survey, and the size of the samples concerned.

Table 13.1:
Countries applying the optional package on Vaccination HL or only the measure on Vaccination HL

Country	HL-VAC items only/full optional package HL-VAC	Type of data collection	Period of data collection	Number of respondents
AT	OP HL-VAC	CATI	16.03.2020–26.05.2020	2,967
BE	OP HL-VAC	CAWI	30.01.2020–28.02.2020 and 01.10.2020–26.10.2020	1,000
BG	HL-VAC items only	CAPI, CAWI	10.–24.11.2020	865
CZ	OP HL-VAC	CATI, CAWI	10.–24.11.2020	1,599
DE	HL-VAC items only	PAPI	13.12.2019–27.01.2020	2,143
HU	OP HL-VAC	CATI	02.12.2020–20.12.2020	1,195
IE	OP HL-VAC	CATI	24.07.2020–07.12.2020	4,487
IT	HL-VAC items only	CATI, CAWI	8.04.2021–08.05.2021	3,500
NO	HL-VAC items only	CATI	04.04.2020–13.05.2020	2,855
PT	OP HL-VAC	CATI	10.12.2020–13.01.2021	1,247
SI	OP HL-VAC	CAPI, CAWI	09.03.2020–15.03.2020 and 09.06.2020–10.08.2020	3,360

Source: HLS_{19} Consortium

13.2 Methods and results

Rasch modeling, confirmatory factor analysis, and reliability indices

The latent trait Vaccination HL was measured using the 4-item Vaccination HL scale with a 4-point Likert scale. As the scale collects polytomous categorical data at the ordinal measurement level, the data were tested against the partial credit parameterization of the unidimensional Rasch model (Masters 1982). Overall data-model fit, single item data-model fit, ordering of the response categories, differential item functioning (DIF), response dependency, and dimensionality were evaluated country by country. Analyses of dimensionality were also used to determine whether the

Vaccination HL scale collected additional information "over and above" the HLS_{19}-Q12 scale (see Section 5.5).

Applying confirmatory factor analysis (CFA) within the structural equation modeling (SEM) framework, dimensionality was assessed by estimating a single-factor (Vaccination HL items and HLS_{19}-Q12 items loading onto one factor) and a two-factor (Vaccination HL items and HLS_{19}-Q12 items loading onto separate factors) measurement model by using a diagonally weighted least squares (DWLS) estimator (Beaujean 2014; Kline 2015; Roussel 2012). To assess how well the model fits to the data, the following goodness-of-fit (GOF) indices were selected and used (with the target values in parentheses):

- Standardized Root Mean Square Residual (SRMR $\leq$ 0.08), which is the averaged sum of the squared elements of the residual correlation matrix. The SRMR value typically increases with the number of indicators i.e., by the model degrees of freedom (*df*),
- Root Mean Square Error of Approximation (RMSEA $\leq$ 0.06), which attempts to correct the tendency of the sample-size dependent chi-square statistics to reject models when the sample size is large; it includes a "parsimony correction" by taking into account the model *df*,
- Goodness of Fit Index (GFI $\geq$ 0.95), which estimates the proportion of covariances in the sample data matrix explained by the model,
- Adjusted Goodness of Fit Index (AGFI $\geq$ 0.90), which is the adjusted GFI taking into account the degrees of freedom of a model relative to the number of variables,
- Comparative Fit Index (CFI $\geq$ 0.95), which measures the relative improvement in fit going from the baseline model, which assumes zero covariance among the indicators, to the correlation structure identified by the postulated model,
- Tucker-Lewis Index (TLI $\geq$ 0.95), which is a CFI corrected for parsimony taking into account the degrees of freedom of the postulated model and the baseline model.

Internal consistency or "test reliability" – the measurement scale's ability to distinguish between respondents with different Vaccination HL scores, or degrees of Vaccination Literacy, was estimated by the Cronbach alpha coefficient and equivalent coefficients, such as the Person Separation Index" (PSI).

The HLS_{19} procedures for reporting results

For analyzing and reporting Vaccination HL, the difficulty of each Vaccination HL item (i.e., the percentage of the responses "very difficult" or "difficult" combined), the Average Percentage Response Patterns (APRP) and the Vaccination HL mean score were estimated. For each item, the proportion of respondents ticking each of the four response categories is available in Annex 13 (Tables A 13.11 to A 13.14).

To calculate the APRP (as described in Section 4.4), the average number of times respondents used each response category while responding to the four Vaccination HL items was estimated. The APRP displays the percentages in which the four response categories were used, on average, by respondents across all Vaccination HL items.

To create a Vaccination HL score, following the HLS_{19} procedure (described in Section 4.2), the four Vaccination HL items were dichotomized by merging the two response categories "very difficult" (1) and "difficult" (2) (values 1 and 2 were recoded to "zero") and the two response categories "easy" (3) and "very easy" (4) (values 3 and 4 were recoded to 1). For each respondent, the recoded values were added to a sum score, and the sum score was standardized to 0–100 according to the HLS_{19} procedure. Thereby, the score indicates the percentage of items the respondents ticked as "easy" or "very easy". Vaccination HL scores were computed only for respondents with a complete data set for the four Vaccination HL items. A higher score means higher Vaccination HL.

Responses to individual items, the Average Percentage Response Patterns (APRP), and the Vaccination HL score were explored for each of the 11 countries.

Vulnerable/disadvantaged subpopulations were identified by comparing the mean score of population groups using t-tests to compare pairs of mean scores.

Regression models

The effects or "regression parameters" of determinants of Vaccination HL, such as gender, age, education, self-perceived level in society, financial deprivation, and training in a health profession, were estimated (as described in Section 4.6) using a multivariable linear regression model for each country and for all countries (equally weighted).

The effect of Vaccination HL on "vaccination behavior" was estimated using a single-level logistic regression model for each country. The variables General HL, socio-demographic and socio-economic background, training in a health profession (for the wording and distribution of these variables, see Chapter 6), and relevant vaccination variables were used as control variables.

13.2.1 Responses at item level by country

Figure 13.1 and Table A 13.15 (in Annex 13.1) show the combined proportion of responses in the "difficult" or "very difficult" response categories for the four Vaccination HL items.

Item 26 "to judge which vaccination you or your family may need" has the highest difficulty in five out of the 11 countries (BE, BG, CZ, DE, and PT) and is rated among the most difficult items in four other countries (AT, HU, IE, and IT). The difficulty of this item varies from around 21% (AT and HU) to 54.0% (BG).

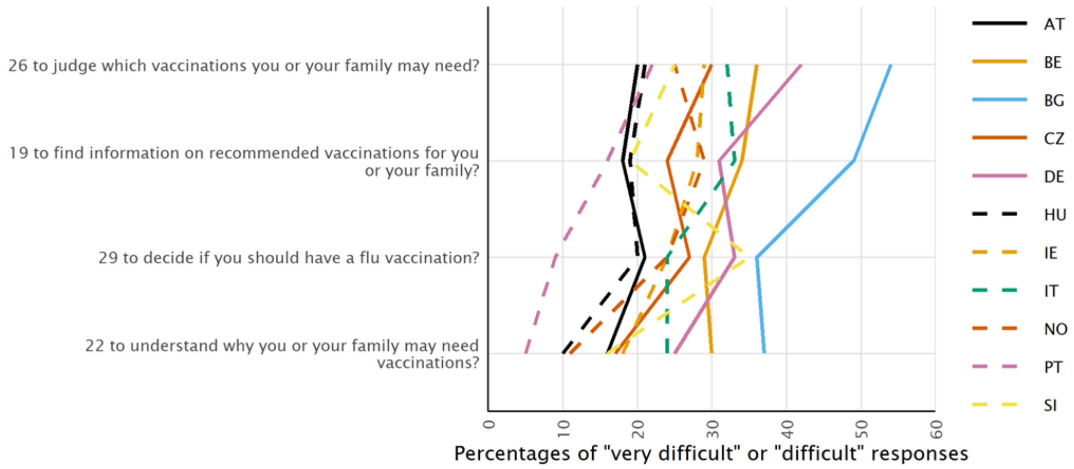
The item 22 "to understanding why you and your family may need vaccination" has the lowest difficulty in eight countries (AT, CZ, DE, HU, IE, NO, PT, and SI) and is rated among the least difficult items in two countries (BE and BG). The difficulty of this item varies from 5.2% (PT) to 36.8% (BG).

Finding vaccination information (item 19) is the most difficult Vaccination HL item in only two countries (IT and NO) and among the most difficult Vaccination HL items in another two countries

(BE and BG). The percentage of difficulties finding vaccination information varies by country between 15.7% to 49.4%, with four countries (BE, BG, DE, and IT) exceeding the 30 percent level.

Applying vaccination information (item 29) is the most difficult Vaccination HL item in SI and in AT. The percentage of difficulties in applying vaccination information varies between countries from 8.8% (PT) to 36.0% (BG), ranging from about 20% to 30% in most countries.

Figure 13.1:
Percentages of respondents who responded with "very difficult" or "difficult" to the HLS19-VAC items (ordered by the overall mean), for each country

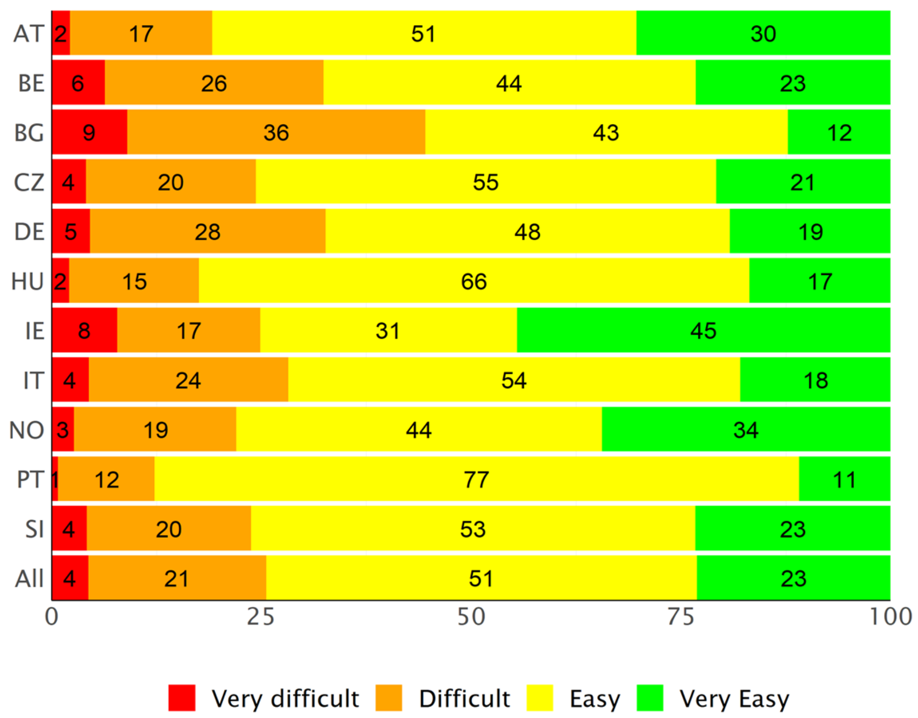


The item IDs are based on the HLS19-Q47, which this item set was derived from.

Source: HLS19 Consortium

Across countries, 4.4% of respondents rated all four Vaccination HL items as "very difficult" and a quarter of respondents ticked either "very difficult" or "difficult" for all four items (cf. Figure 13.2). The percentage of "very difficult" or "difficult" responses varied between countries from 17.6% (HU) to 44.5% (BG), apart from PT (12.3%; see Figure 13.2).

Figure 13.2:
Average Percentage Response Patterns (APRP) across all Vaccination HL items, for each country and the mean for all countries (equally weighted)



Source: HLS19 Consortium

13.2.2 Psychometric properties of the Vaccination HL scale

Rasch modeling

Applying a 4-point rating scale, three "thresholds" were estimated for each of the four Vaccination HL items. Using an "amend sample size" corresponding to 30 respondents for each of the 12 thresholds (n=360), the overall data-model fit to the Rasch PCM was sufficient for Vaccination HL scale data collected in CZ, DE, HU, IE, and IT. The overall data-model fit was acceptable for data collected in AT, BE, NO, and SI. The data collected in BG and PT displayed rather poor overall data-model fit.

The response categories of the four Vaccination HL items were ordered, and no response dependency between items was observed. As the Vaccination HL items displayed DIF for country/language, i.e. the item location or "difficulty order" varied somewhat between countries, the Vaccination HL scale did not measure invariantly across countries (cf. Figure 13.1). Items also displayed

DIF for different person factors, such as age and gender, but there was no consistent overall pattern across countries.

Item 29, which explicitly refers to vaccination against influenza and is therefore "context dependent", taps into an additional influenza-related latent trait and therefore tends to discriminate somewhat poorly in several countries.

As a joint analysis of the vaccination item set and the HLS$_{19}$-Q12 item set did not lead to a unidimensional structure when equating these two item subsets (by using dependent *t*-tests), the vaccination scale and the HLS$_{19}$-Q12 scale seem to empirically measure different latent traits.

Confirmatory factor analysis

Using a two-factor confirmatory factor model, the latent correlation between the Vaccination HL factor and the HLS$_{19}$-Q12 factor was sufficiently low in 10 out of the 11 countries and suggests that discriminant validity is likely to exist between the two scales. Except for IT (0.92), all latent correlations were 0.85 or less, with the lowest observed value (0.57) in the BE data. A sufficiently low latent correlation or "strong discriminant validity" means that the two scales Vaccination HL and the HLS$_{19}$-Q12 seem to measure somewhat different but related traits or competencies.

Table A 13.29 and Table A 13.30 in Annex 13 report GOF indices for the two-factor model and the corresponding single-factor measurement model respectively. In the single-factor model, the Vaccination HL items and the HLS$_{19}$-Q12 items load on one common latent factor. Ignoring the poor GOF indices for the single-factor model (Table A 13.30) for the Belgian (BE) and Czech (CZ) data, the overall trend is that the two-factor model (Table A 13.29) and the single-factor model (Table A 13.30) display good fit. One exception is the high SRMR values $> .08$ for some countries when the single-factor model is applied (Table A 13.30). Due to modeling a large number of variables (4+12 items) the model df is relatively high, and a large SRMR (not corrected for parsimony) and a small RMSEA (which compensates for the effect of model complexity) is expected, as noted by Savalei (2012). Given the size of the SRMR relative to the RMSEA, the single-factor model seems to be "too parsimonious" compared to the two-factor model. A country-wise comparison of the two-factor model to the single-factor model using the Scaled Chi-Squared Difference Test (Satorra/Bentler 2001) strengthened the hypothesis that the two-factor model did significantly better in recreating the observed covariance matrix. Therefore, the Vaccination HL scale seems to measure a different latent trait than the HLS$_{19}$-Q12 scale.

Table 13.2 reports the selected GOF indices for the hypothesized model where the four Vaccination HL items load onto a single Vaccination HL factor. According to the country-wise CFAs, this model recreated the observed covariance matrix quite well for the data collected in all eleven countries, with a somewhat large RMSEA for the Bulgarian data (the correlation of the individual items per country can be seen in the tables in Section 13.2 of the Annex of this Chapter).

Table 13.3 reports the standardized item loading for each of the four Vaccination HL items when loading onto the single Vaccination HL factor. Except for the Bulgarian and Italian data, item 29 has the lowest standardized loading of the four Vaccination HL items at less than 0.7. As the squared standardized item loading (0.7x0.7=0.49 = 49%) can be interpreted as "variance explained", it follows that the latent factor Vaccination HL explains less than 50% of the variance in the responses to item 29 in most countries.

Table 13.2:
Fit indices for the one-factor confirmatory factor model with the four Vaccination HL items as indicators, for each country

	AT	BE	BG	CZ	DE	HU	IE	IT	NO	PT	SI
SRMR	0.02	0.01	0.05	0.03	0.01	0.01	0.04	0.01	0.02	0.03	0.02
RMSEA (CI lower bound)	0.01	0.00	0.04	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.01
RMSEA	0.03	0.00	0.08	0.04	0.00	0.00	0.06	0.00	0.01	0.00	0.03
RMSEA (CI upper bound)	0.05	0.06	0.12	0.07	0.03	0.04	0.08	0.03	0.04	0.05	0.05
RMSEA (p value)	0.91	0.88	0.12	0.69	1.00	0.97	0.19	1.00	0.99	0.94	0.94
CFI	1.00	1.00	0.99	1.00	1.00	1.00	0.99	1.00	1.00	1.00	1.00
TLI	1.00	1.00	0.97	1.00	1.00	1.00	0.98	1.00	1.00	1.00	1.00
GFI	1.00	1.00	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
AGFI	1.00	1.00	0.96	0.99	1.00	1.00	0.98	1.00	1.00	1.00	1.00

AGFI=Adjusted Goodness of Fit Index; CFI=Comparative Fit Index; CI=Confidence interval; GFI=Goodness of Fit Index; RMSEA=Root Mean Square Error of Approximation; SRMR=Standardized Root Mean Square Residual; TLI=Tucker-Lewis Index

Source: HLS_{19} Consortium

Table 13.3:
Standardized factor loadings when the four dichotomized Vaccination HL items load onto a single factor, for each country

	AT	BE	BG	CZ	DE	HU	IE	IT	NO	PT	SI
19 … to find information on recommended vaccinations for you or your family?	0.83	0.91	0.62	0.81	0.78	0.74	0.78	0.78	0.75	0.81	0.80
22 … to understand why you or your family may need vaccinations?	0.95	0.94	0.81	0.87	0.86	0.91	0.81	0.85	0.79	0.82	0.83
26 … to judge which vaccinations you or your family may need?	0.93	0.95	0.90	0.92	0.91	0.88	0.83	0.83	0.92	0.96	0.93
29 … to decide if you should have a flu vaccination?	0.54	0.79	0.66	0.66	0.53	0.65	0.60	0.79	0.56	0.36	0.65

The item IDs are based on the HLS_{19}-Q47, which this item set was derived from.

Source: HLS_{19} Consortium

In line with the result from Rasch modeling, context-dependent item 29, therefore, probably has a specific variance component owing to an unmodeled “influenza” factor not included in the single-factor CFA for the 4-item Vaccination HL scale. Specific variance is displayed as part of an indicator’s unique variance: the more unique the variance the less common the variance, and, accordingly, a lower standardized factor loading.

Reliability

The internal consistency of the Vaccination HL scale was, on average, 0.72, ranging from 0.60 (PT) and 0.67 (NO) to 0.85 (BE). For most countries the test reliability of the Vaccination HL scale was acceptable (cf. Table 13.4) and above the minimum value of 0.70 recommended in the literature (Kline 2015).

Table 13.4:
Cronbach’s alphas for the 4-item Vaccination HL scale, for each country and the mean for all countries (equally weighted)

	AT	BE	BG	CZ	DE	HU	IE	IT	NO	PT	SI	All
Cronbach ’s alphas	0.75	0.85	0.70	0.75	0.71	0.71	0.68	0.75	0.67	0.60	0.73	0.72

Source: HLS_{19} Consortium

13.2.3 Distributions of the Vaccination HL score by country

The distribution of the Vaccination HL standardized score is negatively skewed across all countries. This ceiling effect makes it evident that the Vaccination HL scale could have been better targeted to respondents' Vaccination Literacy, meaning that "more difficult" items should be developed and added to the scale. More items would also strengthen the test reliability of the scale.

Table 13.5 shows the average Vaccination HL score for each country. The mean score varies between 57.6 points (BG) and 87.0 points (PT).

Table 13.5:
Distribution of the Vaccination HL score, for each country and the mean for all countries (equally weighted)

	25th percentile	Median	Mean	75th percentile	SD
AT	75	100	81.1	100	29.7
BE	25	100	67.6	100	38.8
BG	25	50	57.6	100	35.6
CZ	50	100	75.4	100	32.2
DE	50	75	67.3	100	34.2
HU	75	100	82.4	100	27.4
IE	50	100	75.5	100	30.5
IT	50	75	71.6	100	34.2
NO	75	100	78.3	100	28.6
PT	75	100	87.0	100	22.5
SI	50	100	76.6	100	30.7
All	50	100	74.5	100	32.6

Source: HLS_{19} Consortium

13.2.4 Vulnerable/disadvantaged subpopulations

Defining three age categories (18–35, 36–65, and 66+) and using t-tests to compare pairs of mean scores, significantly different mean Vaccination HL standardized scores were observed for the age groups in eight out of the 11 countries. In four countries (BE, CZ, IT, and NO), 18–35 year olds and 36–65 year olds had the lowest Vaccination HL, with no significant difference between these two groups. In IE, 18–35 year olds, in AT, 36–65 year olds, and in PT and SI, 66+ year olds scored, on average, significantly lowest. In DE, it was both the young and the elderly who had the lowest Vaccination HL, without differing significantly from each other (cf. Table 13.6). A significant age gradient in terms of Vaccination HL was only observed in the Irish data.

Differences in mean scores between the three educational categories defined (low, middle, and high), were observed for six out of the 11 countries. In HU, PT, and SI, the "low" education group had the lowest Vaccination HL score. In BG, DE, and NO, only the "high" education group differed significantly from the other two groups (Table 13.6). A significant "educational gradient" with respect to Vaccination HL was observed only for the SI data.

Based on the variable for level in society, using ten response categories 1–10, three groups of status were defined (low 1–4, medium 5–7, and high 8–10). Significantly different scores were observed in all countries except AT (Table 13.6), with a significant gradient in Vaccination HL by level in society for five out of these ten countries (BG, DE, IT, PT, and SI).

A "financial deprivation" score was estimated based on three items aligned with the HLS_{19} methodology by asking how easy or difficult it is usually to afford medication (C-DET9) or medical examinations and treatments (C-DET10), and to pay all bills at the end of the month (C-DET11). These are referred to as the three "areas" of financial deprivation. In all countries the financially deprived subpopulations with "some to severe" deprivation, had a lower Vaccination HL compared to the non-deprived subpopulations (Table 13.6). A gradient of Vaccination HL with increasing financial deprivation is observed for six countries (HU, IE, IT, NO, PT, and SI), but not for five. This could be because examinations, treatments, and medicines are financed to a greater extent by health insurance and the national health system in some countries than in others.

For eight countries (AT, BG, HU, IE, IT, NO, PT, and SI) people with "average to very poor" self-perceived health status reported, on average, lower Vaccination HL than people with "very good" or "good" health status did (Table 13.6). For eight countries (most of which are consistent with the results on self-assessed health status), people with health limitations in everyday life had a lower Vaccination HL than people with no health limitations. Only in three countries were people with chronic diseases characterized by a lower Vaccination HL than people without chronic diseases, but the national study results from Austria indicate that maybe it is not chronic diseases per se that lead to a difference, but the question of whether people can cope with their chronic diseases or not (Griebler et al. 2021).

Table 13.6:
Mean Vaccination HL standardized scores for potentially vulnerable/disadvantaged subpopulations, for each country and all country (equally weighted)

	AT	BE	BG	CZ	DE	HU	IE	IT	NO	PT	SI	All
Gender: male	81.3	66.4	59.9	75.4	66.4	83.1	**73.4**	71.8	**76.9**	87.9	77.0	74.3
Gender: female	81.0	68.8	55.5	75.3	68.1	81.8	77.4	71.5	79.7	86.3	76.3	74.6
Age: 18–35	85.4	**66.0**	62.2	**75.0**	**62.8**	82.8	**68.9**	**72.0**	**76.8**	88.8	75.7	**74.4**
Age: 36–65	**77.3**	**64.4**	59.6	**74.0**	70.7	82.4	75.8	**69.8**	**77.9**	87.1	78.2	**74.1**
Age: 66+	84.9	80.8	46.4	79.3	**64.4**	81.7	84.9	74.9	82.2	**81.7**	**74.0**	75.3
Education: ISCED 0–2 (low)	74.5	87.5	**41.2**	77.7	**58.8**	**74.3**	75.2	70.4	**70.9**	**82.0**	**67.3**	**73.1**
Education: ISCED 3–4 (middle)	81.8	69.8	**46.0**	76.3	**63.2**	83.8	74.2	71.0	**74.1**	89.1	76.9	74.9
Education: ISCED 5–8 (high)	79.9	66.9	63.1	72.0	73.0	84.9	76.5	74.0	81.0	87.2	80.8	74.3
Level in society: 0–4 (low)	78.4	**61.1**	**47.0**	**72.3**	**58.7**	**76.8**	**69.2**	**62.2**	**69.8**	**81.4**	**69.3**	**68.3**
Level in society: 5–7 (middle)	81.1	**65.1**	60.1	**75.0**	67.7	84.6	75.5	73.5	78.3	88.0	78.1	75.4
Level in society: 8–10 (high)	81.8	76.8	67.3	81.6	75.9	84.1	79.6	74.8	81.8	96.8	86.2	79.0
Financial deprivation: none	83.4	71.8	64.5	80.9	71.0	90.0	80.8	79.7	79.7	90.7	84.2	79.3
Financial deprivation: some to severe	**73.4**	**63.2**	**49.9**	**68.9**	**60.7**	**77.3**	**67.5**	**65.1**	**67.8**	**82.1**	**70.9**	**67.9**
Self-perceived health: very good or good	82.2	69.2	64.6	76.7	68.2	85.1	75.7	77.0	79.1	89.0	79.6	77.0
Self-perceived health: average to very poor	**76.0**	65.3	**46.1**	73.5	65.7	**79.0**	**74.8**	**67.1**	**75.0**	**83.5**	**70.4**	**69.7**
Chronic disease or health problems: one or more	79.8	70.0	53.7	75.7	68.2	80.6	78.0	70.3	77.9	**84.0**	**73.5**	**73.0**
Chronic disease or health problems: none	81.9	65.4	61.8	74.9	66.7	83.6	**74.1**	73.3	78.4	88.6	78.6	75.8
Limited by health problems: some to severe	**78.0**	68.8	**46.7**	74.2	**65.9**	**77.2**	77.3	**65.9**	**76.1**	**81.5**	**71.0**	**69.9**
Limited by health problems: not	82.3	73.8	64.7	76.7	69.1	83.9	79.1	75.6	79.4	88.5	79.8	78.6

Values in bold highlight vulnerable/disadvantaged subpopulations.

Source: HLS19 Consortium

13.2.5 Determinants of Vaccination HL

For most HL measures, social gradients have been demonstrated and the relative strength of the effects of different social determinants have been described (cf. Chapter 6). Therefore, this is tested here for Vaccination HL as well using the same potential determinants as for General HL in Chapter 6.

Model 1 (Table 13.7) presents standardized ß coefficients, *p*-values, and R^2 for linear regression models on Vaccination HL with gender, age, education, self-perceived level in society, and financial deprivation as explanatory variables, for each of the 11 countries. It explains on average only 4% (varying from 3% (AT, BE) to 9% (BG)) of the variance of Vaccination HL; thus, there is only a weak social gradient, which differs considerably between countries. For all countries except BG, financial deprivation is the strongest predictor of Vaccination HL (inversely associated) with ß=-0.17 on average, varying by country from -0.08 (BE) to -0.27 (HU). Self-perceived level in society (positively associated) appears to be another important predictor of Vaccination HL with a standardized ß coefficient of ß=0.05 on average being significantly different from zero in seven out of the 11 countries (BE, BG, CZ, DE, IE, NO, and PT), ranging from 0.03 (IE) to 0.13 (PT).The standardized ß coefficient of education level is positive and significantly different from zero in five countries (BG, DE, IE, NO, and SI), ranging from 0.03 (IE) to 0.18 (BG), and negative in the model for CZ (-0.10).The effect of being "female" is significantly different from zero in only three out of the11 countries (DE, IE, and NO), where females have a higher predicted Vaccination HL score than males. In IE, IT, and NO, the predicted Vaccination HL score increases with age, while the score decreases with age in PT.

Model 2 (cf. Table A 13.32 in Annex 13.6) shows a regression model where the variable "trained in a health profession" has been added. This model does not explain more variance for Vaccination HL than Model 1, but there is an "effect" of being "trained in a health profession" which is significantly different from zero (with $p \leq 0.01$) in four out of the eleven countries (BG, IE, NO, and SI). This means that in these countries, the predicted Vaccination HL score is higher for those who are trained in a health profession compared to those who are not when all other explanatory variables are held constant.

In Model 3 (cf. Table A 13.33 in Annex 13.6)) where General HL is added, which is a latent variable measured with standard error. General HL turns out to be the strongest predictor of Vaccination HL for all countries, with a standardized ß of 0.51 for all countries (weighted equally), varying from 0.39 for HU to 0.70 for IT. This result illustrates that General HL and Vaccination HL measure different aspects of HL (as has already been shown with the Rasch analysis and CFA) and that there seems to be a basic skill for dealing with health information that is not topic specific. The Spearman correlation between Vaccination HL and selected determinants is shown in Annex 13.5.

Table 13.7:
Model 1: Multivariable linear regression models of Vaccination HL by five core social determinants (standardized coefficients (β) and R^2), for each country and for all countries (equally weighted)

	AT	BE	BG	CZ	DE	HU	IE	IT	NO	PT	SI	All
Gender female	0.01	0.02	−0.05	0.03	*0.05*	−0.01	**0.06**	0.02	*0.04*	0.00	0.00	0.02
Age in years	−0.02	0.06	−0.05	0.04	0.00	0.03	**0.15**	*0.05*	*0.04*	*−0.08*	0.03	0.01
Education	−0.03	−0.03	**0.18**	**−0.10**	**0.09**	0.01	*0.03*	0.03	**0.12**	−0.07	**0.06**	**−0.04**
Level in society	0.01	**0.12**	*0.12*	*0.06*	*0.07*	0.02	*0.03*	0.02	**0.08**	**0.13**	0.03	**0.05**
Financial deprivation	**−0.16**	**−0.08**	−0.04	**−0.21**	**−0.11**	**−0.27**	**−0.20**	**−0.24**	**−0.09**	**−0.13**	**−0.21**	**−0.17**
R^2	0.03	0.03	0.09	0.06	0.04	0.08	0.08	0.06	0.04	0.06	0.06	0.04
Valid count	2598	988	642	1529	1822	1043	4144	3110	2506	933	3107	
Total count	2967	1000	865	1599	2143	1195	4487	3500	2855	1247	3360	

Coefficients with p-values lower than 0.01 in bold and coefficients with p-values lower than 0.05 in italics.
Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of −0.005 to +0.005.
Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

Source: HLS_{19} Consortium

13.2.6 Consequences of Vaccination HL

Analyses of the consequences of low Vaccination HL, here expressed in terms of vaccination behavior, can be carried out for seven out of the 11 countries. In addition to the determinants of HL considered in Chapter 6, selected specific correlates of vaccinations are considered (confidence in vaccinations, knowledge about risks, risk perception of getting a disease if not vaccinated).

Table 13.8 displays the correlations between Vaccination HL and selected vaccination correlates. In most countries Vaccination HL is significantly positively correlated with the selected variables, except for PT. The higher the Vaccination HL, the higher the confidence in vaccinations, the more realistic the knowledge about the risks of vaccines, and the better the risk assessment of developing a specific disease if not vaccinated.

The strongest correlations are found for confidence in vaccinations, followed by a realistic assessment of vaccination risks, aspects that are influenced by vaccination knowledge and Vaccination HL. The weakest correlation is observed between Vaccination HL and the perception of risks of developing a disease if not vaccinated. Apart from PT, this pattern applies to all countries (cf. Table 13.8).

Table 13.8:
Correlations between the Vaccination HL score and selected vaccination correlates considered in the HLS_{19} optional package on vaccination, for each country and for all countries (equally weighted)

Spearman correlation between HL-VAC score and ...	AT	BE	CZ	HU	IE	PT	SI	All
VAC confidence (score, low to high)	**0.24**	**0.30**	**0.26**	**0.25**	**0.32**	0.04	**0.25**	0.23
VAC knowledge risks (score, low to high)	**0.22**	**0.22**	**0.16**	**0.22**	**0.22**	**0.15**	**0.18**	0.21
VAC risk perception of getting a disease if not vaccinated (single item, low to high)	**0.16**	*0.08*	**0.10**	**0.07**	**0.11**	0.04	**0.14**	0.12

Coefficients with p-values lower than 0.01 in bold and coefficients with p-values lower than 0.05 in italics.

Source: HLS_{19} Consortium

Using a multivariable logistic regression model (not shown) with the dichotomous variable "vaccination behavior" as the dependent variable and the Vaccination HL score as explanatory variables, the odds of "someone in the family being vaccinated in the last five years" increases for five out of the seven countries (AT, BE, CZ, IE, and SI) when the predictor Vaccination HL score increases. This pattern does not change when socio-demographic and socio-economic variables as well as training in a health profession are considered in an extended model (cf. Table 13.9). In Table A 13.34 a model including General HL is shown.

A model that also includes vaccination-specific variables shows (using the Baron and Kenny approach (Baron/Kenny 1986)) that the relationship between Vaccination HL and vaccination behavior is mediated by confidence in vaccinations, risk knowledge, and risk perception, entirely in AT and partially in the other countries (cf. Table 13.10). The model highlights that vaccination information management skills are important to build confidence in vaccinations and to gain a realistic assessment of the risks associated with vaccinations. In addition, a high Vaccination HL helps to assess the risks of developing a disease if not vaccinated. In Table 13.35 a model including General HL is shown.

Table 13.9:
Odds ratios of a multivariable logistic regression model on being vaccinated within the last five years (vaccination behavior) with HL-VAC, gender, age, education, level in society, financial deprivation, and trained in a health profession as determinants, for each country and for all countries (equally weighted)

	AT	BE	CZ	HU	IE	PT	SI	All
Intercept	2.93	2.83	0.59	*0.23*	0.74	*7.06*	1.11	1.22
HL-VAC	**1.30**	**1.19**	**1.35**	1.13	**1.37**	1.03	**1.26**	**1.26**
Gender female	**1.39**	1.05	1.22	1.03	**1.36**	1.58	1.16	**1.19**
Age in years	**0.98**	0.99	1.00	1.00	1.00	*1.02*	**0.99**	**1.00**
Education	**1.14**	1.07	**1.13**	**1.15**	**1.12**	1.09	**1.14**	**1.10**
Level in society	1.01	1.08	1.04	1.06	0.99	0.9	1.04	**1.05**
Financial deprivation	0.91	0.93	0.99	1.05	0.99	*0.78*	*0.91*	**0.92**
No training in a health profession	**0.63**	**0.52**	0.83	1.14	*0.75*	0.93	*0.73*	**0.73**
Pseudo R^2	0.05	0.03	0.04	0.02	0.04	0.03	0.06	0.04
Valid count	2487	988	1522	1026	4105	912	3041	
Total count	2967	1000	1599	1195	4487	1247	3360	

Coefficients with p-values lower than 0.01 in bold and coefficients with p-values lower than 0.05 in italics.
Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of -0.005 to +0.005.
HL-VAC score: from 0=minimal HL to 100=maximal HL.
Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

Source: HLS_{19} Consortium

Table 13.10:
Odds ratios of a multivariable logistic regression model on being vaccinated within the last five years (vaccination behavior) with Vaccination HL, gender, age, education, level in society, financial deprivation, trained in a health profession, and specific vaccination correlates as determinants, for each country and for all countries (equally weighted)

	AT	BE	CZ	HU	IE	PT	SI	All
Intercept	**0.08**	0.58	**0.09**	**0.01**	*0.30*	0.57	**0.14**	**0.14**
HL-VAC	1.07	*1.10*	**1,21**	1.00	**1.24**	0.96	*1.10*	**1.13**
Gender female	**1.60**	1.13	1.17	1.22	*1.25*	1.43	1.19	**1.22**
Age in years	**0.98**	0.99	*0.99*	1.00	1.00	*1.02*	**0.98**	**0.99**
Education	**1.18**	1.03	*1.10*	**1.15**	*1.06*	1.07	**1.10**	**1.06**
Level in society	0.97	1.07	1.04	1.09	0.99	0.94	1.04	*1.04*
Financial deprivation	0.99	0.95	1.03	*1.23*	1.09	0.82	0.91	0.97
No training in a health profession	*0.56*	**0.49**	0.63	1.2	**0.64**	0.78	0.78	**0.70**
VAC confidence (score low to high)	**1.29**	**1.16**	**1.22**	**1.12**	**1.10**	1.19	**1.13**	**1.14**
VAC knowledge risks (score low to high)	**1.29**	1.18	*1.18*	**1.42**	**1.33**	1.28	**1.31**	**1.36**
VAC risk perception of getting a disease if not vaccinated (score low to high)	**1.57**	1.12	**1.33**	*1.38*	1.04	1.18	**1.42**	**1.33**
Pseudo R²	0.19	0.06	0.11	0.08	0.07	0.05	0.12	0.10
Valid count	1924	988	1438	751	3746	706	2460	
Total count	2967	1000	1599	1195	4487	1247	3360	

Coefficients with p-values lower than 0.01 in bold and coefficients with p-values lower than 0.05 in italics.
Due to rounding the numbers to two significant decimals, zeros may represent a value in the range of -0.005 to +0.005.
HL-VAC score: from 0=minimal HL to 100=maximal HL.
Education by 9 ISCED levels, from 0 (lowest) to 8 (highest level).
Level in society from 1=lowest level to 10=highest level in society.
Financial deprivation: 4 categories, from no deprivation (0) to severe deprivation (100).

Source: HLS_{19} Consortium

13.3 Discussion and conclusions

The results on Vaccination HL presented in this chapter are based on a 4-item set of indicators already used in the HLS-EU-Q47, with one item slightly adapted. Thus, the Vaccination HL questionnaire is based on the HL definition developed by Sørensen et al. (2012) and not on a specific definition of Vaccination HL and covers an aspect of HL that is not captured in the HLS_{19}-Q12. The 4-item scale showed acceptable psychometric properties with some DIF for individual countries, which has been considered by reporting the results for each country. There was also some DIF for person factors but not consistently across countries, which can cause a problem in regressions and can affect regression parameters; this has been considered by looking at association patterns across countries and less at the magnitude of regression parameters. Overall, the instrument for measuring Vaccination HL should thus be extended with a focus on more specific Vaccination HL tasks, ideally based on a specific Vaccination HL concept and definition. There are also indications that the different survey methods used (CAPI/PAPI, CATI, CAWI, and combinations) have an influence on the results. For example, computer-assisted telephone interviews seem to lead to better results than other survey methods. Therefore, when comparing countries, the survey method must also be considered. To gain more understanding in this respect, further research is needed.

The main results of our research highlight a considerable issue in dealing with vaccination information in all but one country (PT).

General HL was shown to be a strong predictor for Vaccination HL; likewise, Vaccination HL appears to be a relevant determinant of vaccination behavior in all countries (except for PT) also considering General HL, albeit partly mediated by other relevant vaccination determinants such as vaccination confidence, knowledge about the risks of vaccination, and perceived risks of developing a disease if not vaccinated. These results are consistent with previous studies (Castro-Sánchez et al. 2018; Kitur et al. 2021; Montagni et al. 2021).

The fact that the most difficult Vaccination HL task appears to be the evaluation of vaccination information is relevant on several points. The first is the communication issue, which should be addressed by the media and the scientific community, including the way they interact. The scientific community is responsible for conveying evidence-based information in non-technical language that is understandable for the general population. Relevant support for this action could be provided by journalists and the media in general, which should avoid giving personal interpretations of scientific results and should create a concrete alliance with the scientific community to reduce misinformation and hesitancy as much as possible. We are living in an infodemic; thus, the fight against misinformation and disinformation should be a priority for Europe, as well as for the rest of the world, in the present but also in the future. This is not just a matter for the scientific community and scientific bodies but should be the goal of a coordinated approach followed by governments at various levels (national, regional, and local) in partnership with the scientific community.

A clear demonstration of the dangerous consequences of misinformation is represented by current "facts" related to the Covid-19 vaccination, which have led to a rise in vaccine hesitancy levels and, consequently, to lower coverage rates. This situation should be better considered individually for each country and by comparing countries presenting similarities in vaccination strategies. But in most countries, the results appeared to be the same as those described above, involving struggles to improve strategies. This is relevant, as each country differs in characteristics related to routine vaccinations as well, mainly because of the category of healthcare system in place (e.g., welfare-based, public insurance-based, etc.).

Another important point to be stressed when comparing countries' results is the time when the survey was administered. In most countries it took place during the pandemic but before the availability of Covid-19 vaccines and all the events related to communication in this specific field. In other countries data collection was carried out after "V-day" in December 2020. Even if the questionnaire used did not include Covid-19 vaccination questions, a possible source of bias related to this situation should be considered.

A further point is that the results show that Vaccination HL is lower for people with lower socio-economic status, while age and gender are not associated with the level of Vaccination HL in most of the countries. This seems interesting and is aligned with the highly debated topic of inequalities related to different socio-economic groups, which is well known and vigorously debated in the prevention field. This topic should soon be discussed and solved by several stakeholders, not only by those working in the public health area, but also by institutions and governments, remembering that reducing inequalities is one of the Sustainable Development Goals to be reached before 2030 as defined in the UN Agenda 2030 (United Nations 2015).

Finally, our results show that being "trained in a health profession" has a negative effect on Vaccination HL in six out of the eleven countries considered. This means that the predicted Vaccination HL score is lower for those who are trained compared to those who are not trained, when other explanatory variables are set to zero. This result is particularly interesting as it suggests that in some countries health professionals, despite their training, show lower literacy in vaccination-related matters, highlighting the need for further training and research on this topic.

In conclusion, Vaccination HL has become a topic of interest more than ever due to the current pandemic and Covid-19 vaccinations. Problems still exist, underlining the fact that dealing with vaccination information is not easy at all for populations in all but one country (PT). Evaluating vaccination information is the most difficult Vaccination HL task in almost all countries and, considering the spread of misinformation in the current infodemic, it is an important requirement for dealing with vaccination-related information. Action should be undertaken by the scientific community and at a policy level to raise Vaccination HL with appropriate and effective interventions at community level. No one should be left behind in the process, with the aim of reducing, as much as possible, the inequalities which are associated with lower Vaccination HL, especially concerning socio-economic status.

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14 Health literacy and health-related quality of life as a mediator for health costs

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14.1 Introduction

It has been shown that limited health literacy (HL) results in poorer health and suboptimal use of health system resources (Berkman et al. 2011; Howard et al. 2005; Vandenbosch et al. 2016). The Organization for Economic Co-operation and Development (OECD) has estimated that healthcare systems could save 3-5% of the annual health budget by improving HL of citizens (Eichler et al. 2009). Other countries have similarly assessed the economic burden on their healthcare systems due to low levels of HL in the population. For example, Canada estimates a cost of $8 billion per annum and in the United States (US) an annual cost of $73 billion has been estimated (Kickbusch et al. 2013). Furthermore, people with limited HL may have more difficulties in living a fulfilling life (Kickbusch et al. 2013) and the association between HL and health-related quality of life may therefore be relevant for the costs of health care (Zheng et al. 2018)

The literature is sparse on both the link between limited HL and increased economic costs as the prior literature focuses on the links between low HL and an increased risk of hospitalisation (Baker et al. 2002) which has been investigated in Chapter 9 of this report, and on the link between HL and quality of life (Zheng et al. 2018). Furthermore, most prior research focuses on functional HL, which can be defined as "*the basic skills in reading and writing that are necessary to function effectively in everyday situations"* (Nutbeam 2008) and using functional HL measures. There is a need for research centred around a comprehensive understanding of General HL, which has been defined by the HLS-EU consortium as something that "*is linked to literacy and entails people's knowledge, motivation and competences to access, understand, appraise, and apply health information in order to make judgments and take decisions in everyday life concerning healthcare, disease prevention and health promotion to maintain or improve quality of life during the life course"* ((Sørensen et al. 2012).

The purpose of this chapter is twofold. First to explore whether there is a relationship between General HL (as measured by HLS_{19}-Q12), and health-related quality of life (as measured by EQ-5D-5L), which has cost and economic implications for health services and for society at large. Secondly, the chapter is concerned with understanding the relationship, if any, between HL and work absenteeism.

The structure of this chapter is as follows. The prior research on HL and health care utilization is explored followed by the literature that examines the association between HL and health-related quality of life (HRQoL). To the best of the authors' knowledge no prior studies have examined the relationship between HL and work absenteeism. The research questions and methods adopted are then outlined. The results follow and are presented for the relationship between General HL (as measured by HLS_{19}-Q12), and health-related quality of life (as measured by EQ-5D-5L). Results of the relationship between HL and work absenteeism are also presented. The findings are then discussed and provide evidence to inform future policy along with suggestions for further research. These findings result in a call for investment in and design of HL interventions as a disease prevention strategy at local, national and regional levels which may lead to significant benefits to citizens for their quality of life whilst simultaneously making more effective use of scarce resources and expensive health services.

Previous research on HL and health care utilization

Typically studies on health care utilization focussing on functional HL have been conducted in the US or Asia, and have focussed on a specific population group e. g. people with a particular disease or in a certain age category rather than the general population (Palumbo 2017; Vandenbosch et al. 2016). In addition, for most studies centred around the health care costs associated with HL, the indicators have been measured using self-reporting instruments (Vandenbosch et al. 2016). Only a few studies on HL and HL-related interventions have considered the cost implications of limited HL levels (Eichler et al. 2009).

Many studies claim that limited HL contributes to increased health and medical care costs, based on identified links between limited HL and non-optimal health service utilization alongside negative health outcomes in terms of unnecessary ill health (Berkman et al. 2011; Howard et al. 2005; Vandenbosch et al. 2016). This in turn is deemed to contribute to unnecessarily high costs in health care at both the health systems level and at societal level. However, few studies have explored the financial costs associated with limited HL at either the population level or at the individual level.

Functional HL and health care utilization

Common indicators for estimating the costs of limited functional HL centre on measures of health care utilization (Palumbo 2017). The most frequently used indicators are number of hospitalizations, the use of emergency care and the use of general practitioner services (GPs). Associations between indicators based on the number of hospitalizations and the use of doctor services and functional HL have been found in most studies and seem to be consistent (Palumbo 2017). Associations between functional HL and emergency care are less consistent.

Another group of indicators are individuals' abilities to understand and use health information and instructions correctly, as well as their ability to communicate about health matters. Associations have been found between limited functional HL and less understanding of one's medical condition, impaired ability to interpret labels and health messages, and poorer medication adherence (Palumbo 2017). Other studies have used health status and health care needs as indicators for functional HL costs (Palumbo 2017).

Few studies have investigated the financial costs of limited functional HL. Various health care costs, most often related to health care visits and the use of emergency care, have been calculated either by modelling costs with assumptions of such care costs in general (Eichler et al. 2009; Herman/Jackson 2010; Howard et al. 2005), by using direct costs from medical records and administrative claims data (Herndon et al. 2011; Vann Jr et al. 2013), or by combining these two methods (Eichler et al. 2009) Few studies contain both functional HL level and health care costs at the individual level). The review by Eichler et al. (2009) found that only six studies met all of the authors' inclusion criteria, and none of them explored the cost-effectiveness of interventions in the health care system or at the patient level. The included studies were all from the US, except for Spycher (2006), which combines Swiss functional HL prevalence data with US economic data to produce an estimate for the cost of limited functional HL in Switzerland. However, the US and European health care systems are very different, making the use of US data and modelling assumptions problematic for a Swiss context (Drummond et al. 2005). A further limitation of these studies is that they focus solely on costs to the health system ignoring the costs to the patient or individual.

Limited HL is also likely to incur considerable additional costs to society through work absenteeism (frequent absence of an employee from work) and presenteeism (showing up for work when one is ill) (Garrow 2016). HL is likely to be associated with high levels of absenteeism and presenteeism through the known associations between HL and chronic illness.

General HL and health care utilization

In the past five years, studies have focused on associations between General (i.e. comprehensive) HL and health care costs in different countries across Europe (Berens et al. 2018; Friis et al. 2020; Ousseine et al. 2020; Sørensen et al. 2015; Vandenbosch et al. 2016). Some of those were focused on the general adult population (Berens et al. 2018; Sørensen et al. 2015; Vandenbosch et al. 2016). They have examined costs for health care, using the same or similar indicators as the studies that focused on costs for functional HL. Associations between General HL and the number of GP visits (Friis et al. 2020; Ousseine et al. 2020; Sørensen et al. 2015; Vandenbosch et al. 2016), hospitalizations (Friis et al. 2020; Sørensen et al. 2015) or longer stay in hospital (Vandenbosch et al. 2016) have been demonstrated. Associations between General HL and the use of various forms of emergency care are more inconsistent (Berens et al. 2018; Friis et al. 2020; Vandenbosch et al. 2016). However, the type of doctor's visits, estimation of emergency health care costs and hospital costs, as well as the type of study population varies between these studies, which may explain the inconsistent results. No study, to the best of the authors' knowledge, has explored the cost implications of limited General HL at the health system and the individual level.

Interventions that improve HL (McCaffery et al. 2016; Morony et al. 2018; Muscat et al. 2016) exist, however such studies have not examined the effect of investment in General HL around the costs and benefits of such interventions. Increasingly, governments are undertaking health economic assessments to aid in decisions about funding health interventions; for example, in the UK the National Institute for Clinical Excellence (NICE) determines whether interventions provide sufficient value for money to merit health service funding. This presupposes the calculation of Quality Adjusted Life Years (QALY) as a 'common currency' enabling the costs and benefits of different health interventions to be compared (Guide to the methods of technology appraisal, 2013).

14.1.1 HL and health-related quality of life

Health Related Quality of life (HRQoL) denotes the impact of health on a person's ability to live a fulfilling life, defined by the World Health Organisation (WHO) as an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns (https://www.who.int/tools/whoqol). HRQoL thus represents a broad concept of physical, psychological and social functioning and well-being including both positive and negative aspects ((Karimi/Brazier 2016)).

HRQoL is measured with a variety of instruments such as the Short Form 36 (SF-36) (Ware et al., 1993), for results of one item of this in HLS_{19} see Chapter 8. Special interest has focused on the EQ-5D-5L, which combines evaluation of the individual subject's health state based on five aspects with a set of provided values or weights for each of the health states, based on the preferences of the general population in a country or region. In this way, EQ-5D-5L measures the value that is attached on having specific health conditions as an indication of QALY (EuroQoL).

The association between HL and HRQoL has been examined in a number of studies, recently reviewed by Zheng et al (2018) who found 23 studies including 12,303 participants. Measurements of HRQoL were based on different instruments, most often SF-36 in nine studies and EQ-5D-5L in six studies. Measurement of HL was based on a number of different instruments, mostly REALM and TOFHLA both of which measure functional HL. No studies have yet examined the association between HLS_{19}-Q12 which measures General HL, and EQ-5D-5L.

Nineteen of the 23 studies were combined using meta-analyses, finding a meta-estimate of the correlation between HL and HRQoL of 0.35 (0.25–0.44). Since this review a number of other studies have been published, mostly on patient groups, and two studies have measured General HL (Jovanić et al. 2018; Ozkaraman et al. 2019) using HLS-EU-Q and HRQoL using respectively SF-36 and a cancer-specific instrument for HRQoL measurement.

In summary, more knowledge about the cost implications of General HL for the individual, as well as at the health system and societal levels, is needed. Such knowledge could lead to a better understanding amongst policymakers and health care professionals that General HL is important and something that should be considered in health care delivery and in understanding its impact on society. Similarly, the possible association between limited HL and low quality of life highlights the need to focus on improving HL as a disease prevention strategy and a consequent means to raise the quality of life for the wider population.

HLS_{19} presented an opportunity to collect high quality cost and economic data as well as examining the association with QALY. The optional package 'cost and economics of low HL' enabled a first exploration of societal and individual-level costs of low HL in participating WHO European member states. A further opportunity was the collection of health economic data to enable the utility of investment in HL be calculated using the EQ-5D-5L measure, which is the European standard health economic measure (https://euroqol.org).

Of the countries participating in the HL survey, three (DK, IE and NO) collected the health-related quality of life data. Results from these three countries are presented in this chapter.

14.2 Overall objective and research questions

The overall objective was to explore whether there is a correlation between General HL (as measured by HLS_{19}-Q12 as an independent variable), and the dependent variables of health-related quality of life (as measured by EQ-5D-5L) and absenteeism due to health problems.

The following research questions were formulated:

1. To what extent does General HL (HLS_{19}-Q12) have implications for health-related quality of life as measured by the EQ-5D-5L instrument?
2. To what extent does General HL have implications on absenteeism from work due to health problems?

14.3 Methods

For the cost and health economic analyses, the main objective was to determine the extent to which General HL (GEN-HL), as measured by HLS_{19}-Q12 correlates with “health-related quality of life” as measured by the EQ-5D-5L instrument. In health economic evaluations, a freely available English syntax file for transforming the responses to the EQ-5D-5L questionnaires into an EQ-5D-5L estimate for individual respondents was used. EQ-5D has a scale where 0 represents “death” and 1 represents “full health”.

14.3.1 The statistical analyses

In regression analyses with EQ-5D-5L as the dependent outcome variable, Ordinary Least Squares (OLS) estimation with "robust" estimates of variance to account for violations of homoscedasticity, which is recommended by e.g., Pullenayegum et al. (2010), were used. Using Stata 16, respondents with missing data were "excluded listwise". For the robust estimation the standard errors the Huber-White sandwich estimators were used.

The analysis of «number of days absenteeism per year due to health problems» is based on the two-step model ("Two-part model") where the first step is based on "probit" and the second step on General Linear Modelling (GLM) with gamma "distribution family", log link function and "robust" estimation of variance. The choice is based on recommendations in Deb et al. (2017). In this analysis, only respondents who had answered that they were employed were used.

The procedures for all analyses were based in part on the method described in Thoresen et al. (2012) and assume that all relevant variables are entered simultaneously into the analysis and the statistical analysis is then performed. The variable with the highest *p*-value (i.e., the least significance) is removed and the analysis is run again. This is repeated until only significant variables remain, except for the measurement scale for General HL, which is retained in the model regardless. Next, variables that were removed earlier in the elimination process are entered and retested to see if they become significant in the new combination of independent variables. Interaction and polynomial transformations (quadratic elements) were included in the analyses. The variables employed for this were entered into the model from the start of the elimination process as described above. These are shown in Table 14.1 below. In instances where the significance levels of the variables were inconclusive, the explanatory power of the different models was relied upon. The models remaining after the process described above are presented in Table 14.2. This procedure is based on Thoresen et al. (2012)

The average of the dependent variables was estimated based on the regression equations. In these estimations and for the estimations that form the basis for the figures in this chapter, the margins command in Stata was used. The estimation methods followed Cameron/Trivedi (2010) and Deb et al. (2017).

14.3.2 The variables included

Table 14.1 provides an overview of the variables included in the analyses of the EQ-5D-5L variable and days absent from work due to poor health. The original variable for education was an ordinal variable based on the ISCED system. This variable was converted to number of years of education. The conversion was done as followed: ISCED level 0, 1, 2, 3, 4, 5, 6, 7, and 8 were converted to 0, 7, 10, 13, 14, 16, 18, and 21 years, respectively. Due to the pandemic some people were "temporarily unemployed" in some countries. There is a possibility that this has been registered somewhat differently for the various countries. Therefore, in some countries, this category may be imprecise due to the pandemic.

Table 14.1:
Independent variables used to explain variance in the dependent outcome variables

Independent variables	Variables included		Values
	EQ-5D-5L score	Days of absence	
General HL (GEN-HL)	X	X	0-100
Control variables			
Age (years)	X	X	
Male	X	X	0, 1
Education (years)	X	X	0-21
Trained in a health care profession (THP)	X	X	0, 1
Student	X		0, 1
Unemployed	X		0, 1
Retired	X		0, 1
Interactions			
Education x GEN-HL	X	X	
Education x Age	X	X	
THP GEN-HL	X	X	
Gender x THP	X	X	
Gender x Unemployed	X		
Polynomial transformations			
Age squared	X	X	
Education squared	X	X	
GEN-HL squared	X	X	

Source: HLS_{19} Consortium

14.1 Results

14.1.1 HL and Health-related quality of life

In this section the results concerning the association between HL and health-related quality of life (EQ-5D-5L) in the Irish, Danish, and Norwegian data is presented. Several variables were used as potential confounders.

A significant association between General HL (GEN-HL) and health-related quality of life (EQ-5D-5L) can be seen for all three countries (Table 14.2). For all countries, age, gender, education and being unemployed explain variances in EQ-5D-5L. The explanatory power of the models for the three countries varies from 6.3% to 7.9%.

Table 14.2:
Multiple linear regression with health-related quality of life (EQ-5D-5L) as the dependent variable (unstandardized coefficients (b) and R^2), for Denmark (DK), Ireland (IE) and Norway (NO). Variance is estimated by using robust estimation. Cells are empty because the variables were not part of the regression models.

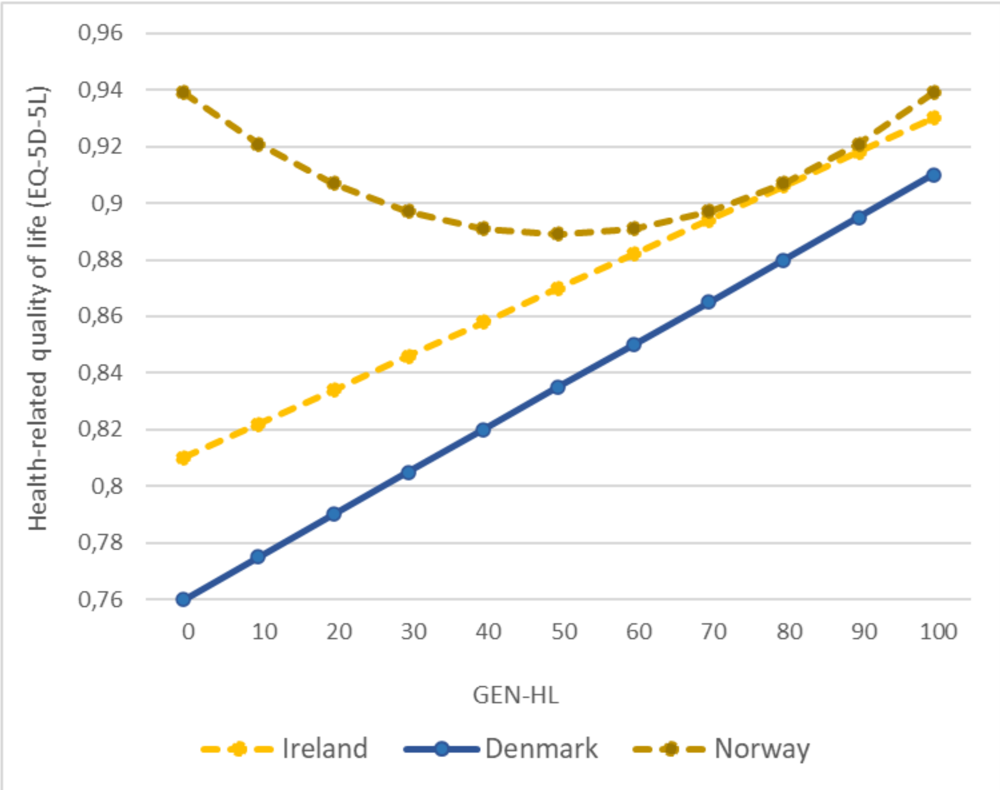
Variables	DK	IE	NO
General HL (GEN-HL)	.0015 ***	.0010 ***	–.0020 **
Age	.0021 *	–.0005 ***	–.0006 ***
Male	.0135 **	.0158 ***	.0284 ***
Education	.0177 ***	.0063 ***	.0069 ***
Training in a health care profession (THP)		–.0934 **	
Student	.0266 *		.0363 ***
Unemployed	–.0607 **	–.0398 ***	–.0487 *
Retired		–.0134 *	
GEN-HL squared			.00002 ***
GEN-HL x THP		.0009 *	
Education x Age	–.0002 **		
Constant	.5274 ***	.7555 ***	.8495 ***
R^2	6.7%	7.9%	6.3%
Valid Count	3 566	4 440	2 785
Total Count	3 602	4 487	2 885

*: p<.05, **: p<.01, ***: p<.001

Source: HLS_{19} Consortium

Figure 14.1 below shows a positive relation between GEN-HL and health-related quality of life (EQ-5D-5L) for Ireland and Denmark. For the Irish data the difference between a Q12 score of 10 (EQ-5D-5L = 0.822) and 100 (EQ-5D-5L = 0.930) is 0.108 EQ-5D-5L score. For Denmark the same difference is 0.135 EQ-5D-5L score (0.910 – 0.775).

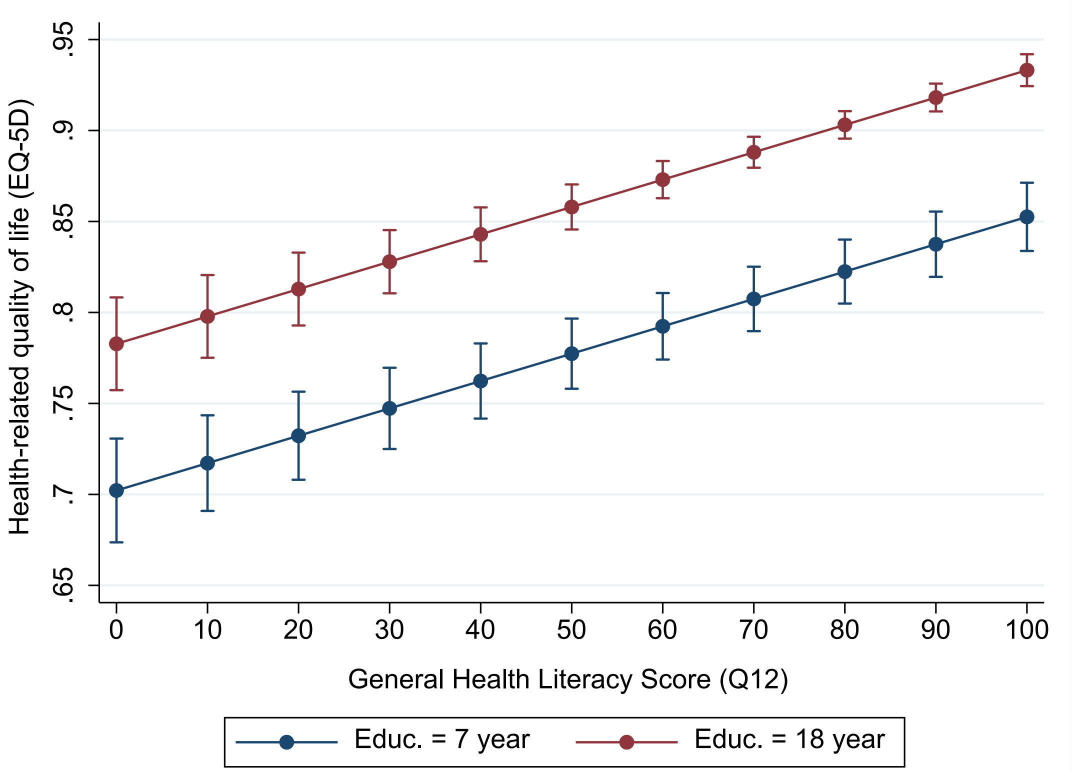
Figure 14.1:
The relationship between GEN-HL on the x-axis, and health-related quality of life (EQ-5D-5L) on the y-axis for DK, IE, NO. The graphs are predictive margin plots. They are based on the models presented in Table 14.2, and all the other variables in the models are kept constant on their average.



Source: HLS19 Consortium

For Norway, the same relation is observed when the GEN-HL score is from 50 to 100, 94% of respondents (2,655 respondents) are within this interval. The difference between a respondent with GEN-HL score of 50 (EQ-5D-5L = 0.889) and a respondent with 100 (EQ-5D-5L = 0.939) is an EQ-5D-5L score of 0.05. However, an opposite association was found for Norwegian respondents with GEN-HL scores between 0 and 50. Here, the EQ-5D-5L score decreased as the GEN-HL score increased. This is unexpected and contradicts an earlier study from Norway (Le et al. 2021b) where another GEN-HL score was used, and where the results were similar to Ireland and Denmark above. Of note is that the levels of uncertainty, as indicated by the 95% confidence intervals, are very high in this part of the graph, reflecting the low numbers of participants (see Figure A 14.1 in the Annex of this chapter), indicating that this finding should be interpreted with caution. The uncertainty is high, partly because only 6% (179 respondents) of the sample has a GEN-HL score less than 50.

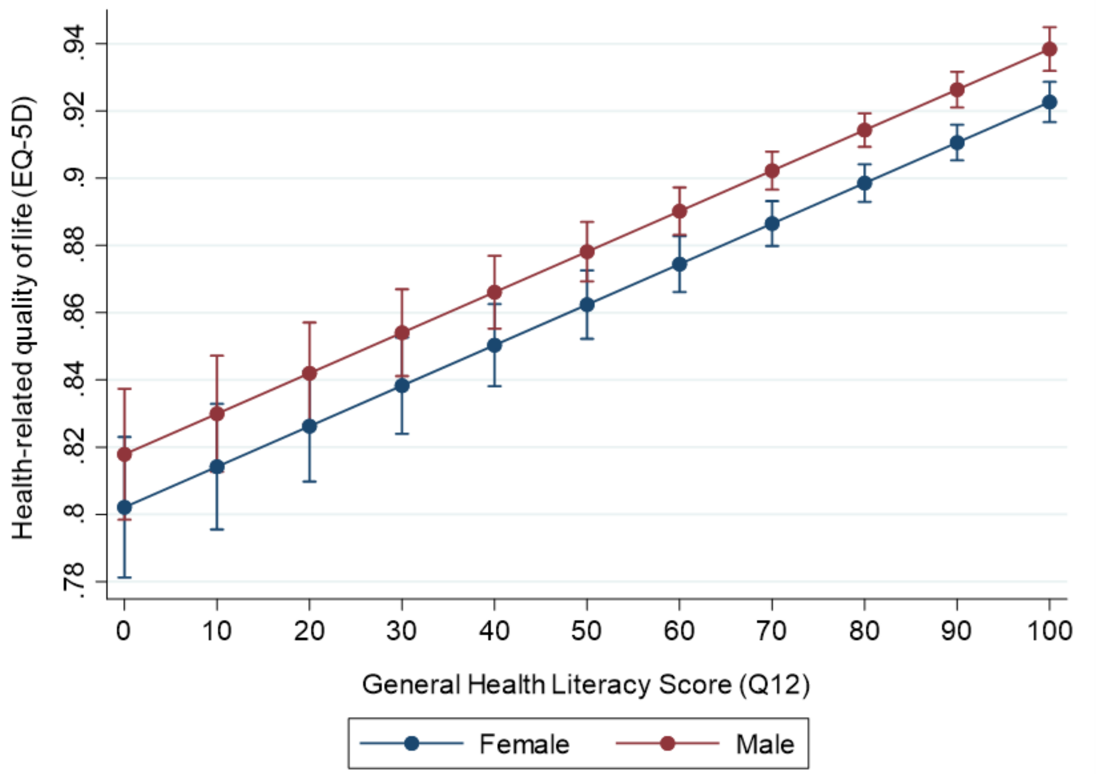
Figure 14.2:
The relationship between GEN-HL on the x-axis, and health-related quality of life (EQ-5-5LD) on the y-axis, shown for different levels of education in **Denmark**. The graphs are predictive margin plots. They are based on the Danish model presented in Table 14.2. The estimates are computed keeping all the other variables in the model constant at their average. The vertical lines represent the 95% confidence intervals for the point estimates



Source: HLS19 Consortium

For all three countries, it was found that a higher educational level is associated with increased health-related quality of life (Table 14.2). Figure 14.2 shows this for Denmark, and the EQ-5D-5L score for people with seven years of education is lower than for people with 18 years of education (master's degree or equivalent). The difference in education between these groups is estimated to be a difference in the EQ-5D-5L score of 0.081. This shows the isolated effect of education when all the other variables shown in Table 1 are kept constant. Respondents with both low HL and low education had particularly low EQ-5D-5L scores. The difference between having a GEN-HL score equal to 10 and seven years of education versus having a GEN-HL equal to 100 and 18 years of education, respectively, is a difference of 0.216 in the EQ-5D-5L score.

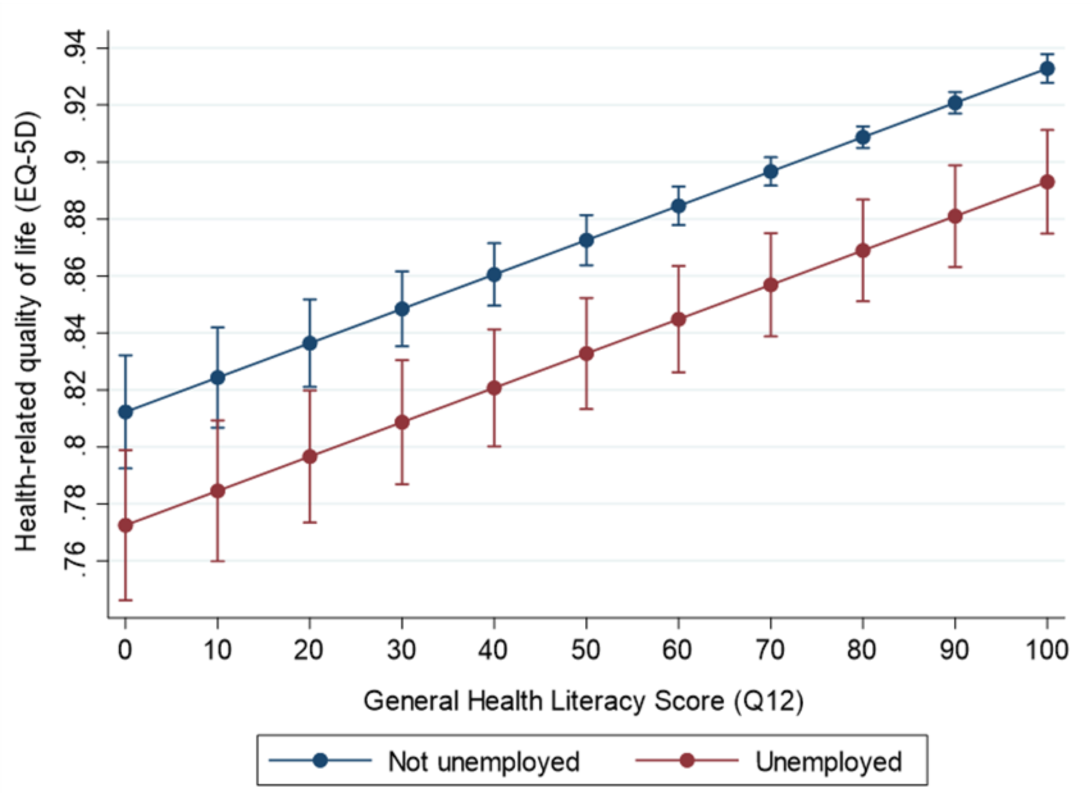
Figure 14.3:
The relationship between GEN-HL on the x-axis, and health-related quality of life (EQ-5D) on the y-axis, shown for females and males in **Ireland**. The graphs are predictive margin plots. They are based on the Irish model presented in Table 14.2 and all the other variables in the model are kept constant at their average. The vertical lines represent the 95% confidence intervals for the point estimates.



Source: HLS19 Consortium

Figure 14.3 shows, that at a certain level of HL, females have a lower EQ-5D-5L score than males, and that the difference is 0.0135 EQ-5D-5L score. For Norway and Ireland, the difference is 0.0284 and 0.0158 EQ-5D-5L score, respectively (see Table 14.2).

Figure 14.4:
The relationship between GEN-HL on the x-axis, and health-related quality of life (EQ-5D-5L) on the y-axis, shown for unemployed and employed individuals in **Ireland**. The graphs are predictive margin plots. They are based on the Irish model presented in Table 14.2, where all the other variables in the model are kept constant at their average. The vertical lines represent the 95% confidence intervals for the point



Source: HLS19 Consortium

Figure 14.4 shows that unemployed persons have a lower EQ-5D-5L score than persons who are employed (working, retired etc.). The differences are 0.040, 0.06 and 0.049 EQ-5D-5L score respectively for Ireland, Denmark, and Norway. For the Irish respondents, being unemployed and having limited HL appears to have additive adverse associations with health-related quality of life. This finding was not seen in the Danish or Norwegian data.

14.1.2 HL and absenteeism

The results from the analyses for Ireland, Denmark, and Norway of the relationship between absence from work and HL are presented, using several other variables as control variables.

Table 14.3:
Multiple linear regression of absence from work due to health problems as the dependent variable (unstandardized coefficients (b) and R^2), for Denmark (DK), Ireland (IE) and Norway (NO). Cells are empty because the variables were not part of the regression models.

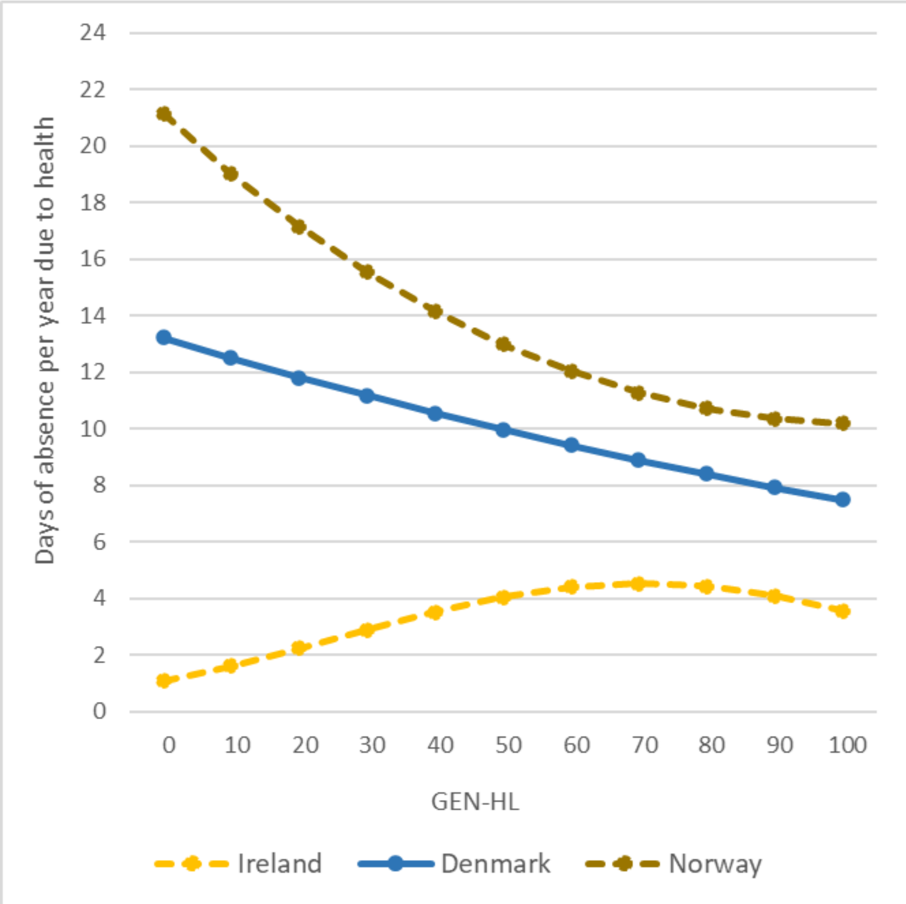
Variables	DK	IE	NO
Step 1: How do the variables associate with whether the respondents have zero days of absence versus one or more days of absence (probit model)?			
General HL (GEN-HL)	-.0016	.0163	.0008
Age	.0117	-.0154***	-.0122***
Male	-.2242**	-.2640***	-.3377***
Education		.0035	-.0407
Training in a healthcare profession (THP)	.2507**	.1951*	1.4401*
GEN-HL squared		-.0001*	
Age squared	-.0003		
Education squared			.0028
GEN-HL X Education		-.00002	
GEN-HL X THP			-.0023
Education X THP			-.0766*
Gender X THP		-.0113	
Constant	.5672	.1863	.9056
Step 2: For those respondents who have one or more days of absence, how do the variables covariate with the number days of absence (GLM)?			
General comprehensive HL (GEN-HL)	-.0048	.0645**	-.0121**
Age	-.0802*	.0078	.0132*
Male	.0952	-.1520	-.3818**
Education		.1109	.1753*
Training in a healthcare profession (THP)	.4860**	.2079	-2.6203*
GEN-HL squared		-.0002	
Age squared	.0009*		
Education squared			-.0091**
GEN-HL X Education		-.0024*	
GEN-HL X THP			.0317***
Education X THP			-.0027
Gender X THP		-.4865*	
Constant	4.5109***	-.7902	2.9403***
R^2	2.46 %	2.76 %	2.84 %
Valid Count	1596	2401	1570
Total Count	1670	2467	1622

*: p<.05, **: p<.01, ***: p<.001

Source: HLS_{19} Consortium

The two-part model provides two kinds of estimates. The first step of the model provides estimates for the variables which are associated with either zero days of absence from work or one or more days of absence. The second step focuses only on the respondents who had one or more days of absence from work. For these respondents, the analysis explores which independent variables covariate with the number of days of absence (step 2). Table 14.3 shows that in step 1 General HL is not significantly ($p > .05$)) associated with absence from work for any of the countries. In step two General HL is significant for Ireland and Norway. The explanatory power of the models *lies between 2.46% to 2.84 % for the three countries.*

Figure 14.5:
The relationship between GEN-HL on the x-axis, and days of absence per year due to poor health on the y-axis. The graphs are predictive margin plots. They are based on the country models presented in Table 14.3, and all the other variables in the model are kept constant on their average



Source: HLS19 Consortium

For Norway, the increased General HL is associated with decreasing absence from work due to health problems. For the Norwegian respondents, it can be seen, that the difference between a GEN-HL score of 10 (days absent = 19.0) and a score of 100 (days absent = 10.2) is about 8.8 days. For Denmark, the same negative association between HL and absenteeism is found, but this association is not significant for any of the steps. The p-values are 0.34 and 0.12 in step 1 and 2, respectively.

In Ireland the days of absence from work due to health problems increases when GEN-HL score increases from 0 to about 70, but absenteeism decreases thereafter. 73.1% (1,797 respondents) of the respondents have a GEN-HL score between 70 and 100.

From Figures A 14.4 – A 14.6 in the Annex the uncertainty for these three graphs is very high in some places.

14.2 Discussion and Conclusions

14.2.1 Main Findings

Our findings answer the two research questions posed:

1. To what extent does General HL (HLS_{19}-Q12) have implications for health-related quality of life as measured by the EQ-5D-5L instrument?
2. To what extent does General HL have implications on absenteeism from work due to health problems?

Research Question 1

The analysis of Health-Related Quality of Life (HRQoL) as measured by EQ-5D-5L, in the three countries that collected these data, shows a significant association between General HL and health-related quality of life. As HL increases so does HRQoL. The reverse direction of association for Norwegian respondents with HL scores below 50 is unexpected; the numbers of respondents in this category is low, as reflected by the large 95% confidence intervals (Figure A 14.1 – Annex), meaning that this finding should be interpreted with caution.

The magnitude of the association between General HL and HRQoL is larger than that for the association between education and HRQoL highlighting the importance of HL interventions to improve General HL levels for adult populations. The associations observed between HRQoL and General HL and other social determinants of health appears to be additive for education level, gender and employment status.

For comparison, the magnitude of the differences seen should be considered as fairly large, as e.g. Yabroff et al (2004) found that the difference in health-related quality of life between cancer patients and the control group without cancer was 0.06 measured with the "Health Activities and Limitation Index (HALex)". This index is based in part on EQ-5D-5L and uses a similar scale from 0-1.

As reported in Chapter 9, General HL is associated with health service utilization; lower HL is associated with more contacts with General Practitioners and higher emergency service utilization significantly for some countries. Of note is that, for both HRQoL and health service utilization, the extent of the associations, and whether they reach statistical significance, varies between countries. This is likely to reflect the importance of national context on the impact of limited General HL on health and health service use.

Research Question 2

For both Norway and Denmark, a negative association between HL and absenteeism can be observed, as General HL increases there is a decrease in absenteeism from work due to health problems. For Ireland when General HL score increases from 0 to about 70, absenteeism increase however decreases thereafter, noting that 73.1% (1,797 respondents) of the respondents have a General HL score between 70% - 100%. These findings suggest that further research and analysis of the HLS_{19} international data is required to more fully understand the complexities surrounding the association between HL and absenteeism from the workplace.

14.1.1 Strengths of the investigation of HL and health-related quality of life as a mediator for health costs

This is the first European study to explore and measure the relationship between General HL (as measured by HLS_{19}-Q12) and health-related quality of life (as measured by EQ-5D-5L) which have consequential cost and economic implications for the health services, for individuals and for society. This is therefore the first generation of data to directly measure General HL alongside health-related quality of life and days absent from work due to poor health. The sample size within this study is large across the three countries where the health-related quality of life data were collected for EQ-5D-5L. Unlike prior studies of the health economic implications of HL all the data were directly measured, with no data inferred.

14.1.2 Limitations of the investigation of HL and health-related quality of life as a mediator for health costs

The analyses in this chapter examines the strength of covariance between the measurement scale for General HL (independent variable) and the dependent variable EQ-5D-5L and absence from work due to poor health. Cross-sectional studies are typically limited in their ability to analyse cause-and-effect factors. More suitable designs to offer indication of this would be longitudinal designs. The fact that there is an association is not a sufficient basis for concluding that a cause-and-effect factor is present, however it represents one of multiple factors that should be present to consider whether one factor might be the cause of another, e. g. that increased HL gives rise to increased health-related quality of life.

It is important to note also that data were collected using different modes of collection Computer Assisted Telephone Interviewing (CATI (Ireland and Norway) and Computer Assisted Web Interview (CAWI) (Denmark).

14.2.2 Implications for future research

As a result of these findings, it is reasonable to hypothesise that General HL impacts on health-related quality of life as demonstrated here for EQ-5D-5L and absenteeism and in Chapter 8 for other indicators and results in higher health service utilization as shown in Chapter 9. These hypotheses should be investigated using research approaches that can demonstrate causality, such as longitudinal studies.

The findings presented also make the case for estimations of the financial impact of limited General HL. Combining the findings on the associations between limited General HL with national health care costs would enable countries to see the actual cost of limited General HL in terms of health service costs. Further studies could also include measures capturing wider personal and societal costs such as the associations between General HL and, for example, absenteeism and presenteeism.

EQ-5D-5L is a useful measure to use alongside the General HL measure, HLS_{19}-Q12, and therefore could be used to assess change in HRQoL with HL interventions. Such studies on HL interventions where data are collected before and after an intervention will enable more granular cost data to be gathered at the patient and individual level rather than only at the population level.

The results of this study demonstrate an association between General HL and health service utilisation in Chapter 9 and General HL and health-related quality of life and absenteeism in this chapter and in Chapter 8, thereby providing evidence to support a call for research studies to be designed to understand causality and to obtain an in-depth understanding of the drivers of preventable health care costs to health care systems and to individuals. This is critical in light of limited resources in the context of escalating expenditure on health care globally in tandem with ageing populations.

14.2.3 Implications for policy

The findings of the HLS_{19} study are sufficiently strong for national and local governments to recognise the importance of General HL for the health and well-being of their citizens and in the utilization of health services. Investment in HL interventions as a disease prevention strategy at local, national, and regional levels may lead to significant benefits to citizens' quality of life and more effective use of scarce resources and expensive health services. For Ireland, being unemployed and having limited HL appears to have additive adverse associations with health-related quality of life. This warrants further investigation to understand why this occurs in Ireland and not in Denmark or Norway. This finding suggests a need for HL interventions designed specifically for unemployed persons.

14.2.4 Conclusion

To the knowledge of the authors, this is the first exploration at individual respondent level, between General HL and HRQoL as measured by the EQ-5D-5L and of absenteeism from work due to poor health. The findings show a significant relationship between General HL and HRQoL, that appears to be augmented by other social determinants of health such as education, gender and employment. The findings also show, in most instances, a negative association between HL and absenteeism, as General HL increases there is a decrease in absenteeism from work due to health problems.

The findings in Chapter 9 also confirm those of the previous European Health Literacy study (HLS-EU) that limited General HL is associated with higher health care utilization.

Taken together, these findings indicate the likely impact of limited General HL on peoples' health-related quality of life, absence from work and on health care and societal costs. Further research should be undertaken to examine the issue of causality. The findings of this study are, however, sufficiently strong for policy makers to take steps to actively incorporate HL and HL interventions into local, national, and regional policies.

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15 Recommendations for policy, practice, and research

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In the HLS_{19}, the integrated, comprehensive definition of health literacy as defined by the HLS-EU Consortium was used: "HL is linked to literacy and encompasses people's knowledge, motivation and competencies to access, understand, appraise and apply information to form judgments and take decisions in terms of healthcare, disease prevention and health promotion to improve quality of life during the life course" (HLS-EU-Consortium 2012; Sørensen et al. 2012)

This definition and the refined study design of the HLS-EU study guided the HLS_{19} survey with its 17 participating countries (AT, BE, BG, CH, CZ, DE, DK, FR, HU, IE, IL, IT, NO, PT, RU, SI, and SK) from most parts of the WHO European Region. The empirical results of this international survey are the basis for the following recommendations. Furthermore, actions for potential interventions to improve HL are proposed for planning health policy to deal with the identified problems and potentials for improvements.

The recommendations address policy and decision makers, practitioners, and researchers at the level of the WHO European Region as well as at national or regional levels. They are divided into three sections and structured as follows:

a) General HL: Section 15.1 covers overall recommendations and proposed actions that relate to General HL and the specific facets of HL measured in the survey.
b) Specific HLs: Section 15.2 highlights recommendations and proposed actions that apply to the specific HLs measured within the HLS_{19}: Navigational HL, Communicative HL with physicians, Digital HL, and Vaccination HL.
c) Research: Section 15.3 summarizes recommendations and proposed actions for further research on population HL for adults at national levels, especially for a next round of the HLS.

While the data, resulting recommendations, and proposed actions building on the HLS_{19} are of specific relevance to the 17 participating countries and the WHO European Region, they may also serve as a basis for other countries and regions, especially in relation to those findings that are universal in nature. They will be highlighted in more detail below.

However, to select the areas where interventions are needed most and have the greatest potential to address HL, countries will need country-specific results and data. Therefore, countries are encouraged to invest in undertaking regular national HL surveys, following the example of the Health Behavior in School-Aged Children (HBSC) study (http://www.hbsc.org/) (see Recommendation 1 below).

While the data from the HLS_{19} survey provide evidence for areas where interventions are needed, they do not measure or estimate the feasibility, effectiveness, efficiency, or cost-effectiveness of potential interventions. For that, more research is needed, which is beyond the scope of the resources of the HLS_{19}. Therefore, many of the proposed and potential actions in this chapter are primarily based on the criterion of plausibility.

The recommendations and proposed actions consider the fact that HL can be addressed by interventions aimed at improving personal HL and/or by enhancing the HL responsiveness of situations, settings, organizations, or systems, or by a combination of both.

Improvements in the personal HL of populations usually provide learning opportunities. These work best for children in schools, (health) professionals, and chronically ill patients (or people with chronicity). Yet enhancing these opportunities will only produce results in terms of competencies, skills, and knowledge when participants are motivated and have the capability to learn. Furthermore, as far as knowledge is concerned, information resources need to be updated when new information becomes available. For health and disease, this is continuously the case at rather short intervals. In addition, people tend to forget information that they do not use on a regular basis. Therefore, interventions addressing the HL responsiveness of organizations, situations, or systems are also needed and partly preferred.

Improvements to the HL responsiveness of situations in which people must decide and act focus on the availability of up-to-date, understandable, reliable, and actionable health-related information on the organizational and systemic levels. This kind of intervention has the potential to reach large numbers of people and facilitate the accessibility, understandability, appraisability, and applicability of health-related information for many at once and can be up-dated regularly more easily.

Applying the results of the HLS_{19}, the decision whether to focus on personal or situational HL or on both will depend on the specific context and problem as well as on the availability of tested, feasible, and acceptable interventions, coupled with evidence or the plausibility of their effectiveness.

To make best use of these recommendations and proposed actions, they need to be adapted and refined as a function of national or subnational HL levels and results as well as of existing policy and practice contexts. Ideally this should be based on prior mapping. When planning concrete interventions, it will often be preferable to start pilot interventions first and to evaluate these before investing in further systematic rollouts.

15.1 Recommendations and proposed actions relating to General HL

Regarding the General HL of populations, the HLS_{19} study supports the results of the first comparative European Health Literacy Survey (HLS-EU) and other studies that have highlighted the relevance of HL for people's health and healthcare outcomes as well as for health policy.

The findings confirm the hypothesis that lower levels of HL are associated with indicators of personal health and the outcomes of healthcare systems: lower HL is associated with more unhealthy lifestyles (lower fruit and vegetable consumption; less physical activity) (see Chapter 7), with lower health status (poorer self-perceived health, more long-term illnesses/health problems, more limitations due to health problems) (see Chapter 8), and with more frequent utilization of healthcare services (emergency services, GPs/family doctors) (see Chapter 9), and therefore also with lower quality of life (compare Chapter 14).

This is even more relevant because a considerable proportion of the adult resident population in each country that participated in the HLS_{19} has low levels of HL and therefore has a higher probability of suboptimal personal health and healthcare outcomes. Across the countries that participated in the HLS_{19}, between 25% and 72% of the respondents had limited HL, in other words they experienced considerable difficulties in completing tasks related to the management of health-related information and communication. In relation to these difficulties, a social gradient (i.e., inequalities in HL status are related to inequalities in social status/level in society) was demonstrated, but to a different degree, for the participating countries.

HL, therefore, must be considered a critical determinant of health (Shanghai Declaration 2016) and healthcare utilization. Moreover, HL can be a *modifiable* determinant of health, which makes it feasible to address and improve low HL with the help of interventions addressing systems or organizations as well as groups of persons.

Recommendation 1: Health policy should include an investment in longitudinal studies, measuring and monitoring population HL, following the example of the WHO's Health Behavior in School-Aged Children (HBSC) study, and should implement interventions to improve HL.

Actions proposed for possible interventions in this respect – from simple awareness-raising to creating impact – include:

- *Agenda setting for HL policy, practice, and research with relevant decision makers, funders,* managers, and stakeholders (professionals, clients) from different sectors and settings in society
  - *by policy briefs, conferences, workshops, newsletters, websites,*
  - *by linking HL to other health policy priorities (such as patient safety, patient orientation, patient's self-management, noncommunicable diseases, Sustainable Development Goals) in the sense of HL mainstreaming,*
  - *by including HL in national (public) health goals and by developing specific action plans for HL.*
- *Capacity building for HL policy, practice, and research (providing leadership and governance, strengthening organizational infrastructures, securing specific and sufficient resources (finances, high-quality materials, and tools), developing knowledge, training the health workforce, strengthening partnerships).*
- *Legal regulations for HL practice: defining HL as a responsibility of health systems, defining quality standards for the HL capacity of (healthcare) organizations, (health) professionals, and publicly available information as well as defining incentives for good HL practice.*
- *Investing in specific programs on improving HL practice in different sectors of society (health care, education, work, mass media, politics) based on prior mapping.*
- *Investing in regular, standardized, internationally comparable monitoring and research of HL.*

15.1.1 Recommendations and proposed actions concerning specific population groups most affected by limited General HL

While low HL is a widespread problem in the population of all participating countries, some population groups are more affected by the consequences of lower HL than others. Ordered by the extent of deviation in HL from the general population, an increased probability of low HL and of the consequences which lower levels of HL represent was observed among people with low self-perceived health (very bad or bad health), those experiencing financial deprivation, those having a self-perceived low level in society (categories 1–4), and those with a lower level of education (ISCED 1 or 2) (in some countries). In addition, frequent utilization of a GP or family doctor (6+ contacts per year), older age (76 or older) (although not in all countries), and long-term illnesses or health problems (1+) are associated with lower HL as well.

Recommendation 2: While efforts to improve HL, especially when applied on system and organizational levels, are beneficial to the population at large, interventions should be specifically targeted at at-risk groups for low HL to reduce the health gap between groups.

The following proposed actions for potential interventions addressing target groups should be considered:

Systems-level interventions

- *Provide regulations and incentives to support the implementation of HL-supportive information and communication strategies, including services especially for vulnerable groups (for example, by making compliance with HL-related criteria a condition for receiving public funding and by including criteria in quality schemes).*
- *Monitor the HL responsiveness of relevant services for vulnerable groups, for example in national quality reports.*

Organization-level interventions

- *Adopt a universal precautions approach to HL/organizational HL/HL sensitivity approach, for example by including HL in quality management.*
- *Train staff in HL-friendly communication (clear language, using techniques like teach-back or chunk-and-check or norm-critical relevant and pedagogical images).*
- *Prioritize target groups in most need of support. Typically, these will include people with lower general education, lower perceived social status, those suffering from financial deprivation, and older people. A risk of low HL may also exist for people with migration backgrounds, especially when they are not familiar with the local language.*
- *Provide quality assured information in different languages and provide interpreting services.*
- *Improve the availability, accessibility, understandability, appraisability, and applicability of high-quality information in major formats (written, audio-visual, digital) on selected topics for selected target groups by involving members of the target groups in defining problems and selecting topics as well as in developing and testing materials.*

Individual-level interventions

- *Provide specific training courses and material in clear language to support the HL of vulnerable groups (using chunk-and-check or norm-critical relevant and pedagogical images).*
- *For people with very low HL, provide personal assistance/case management to compensate for low HL.*
- *Use relevant contact points and influencers from selected target groups (including health professionals and other key staff) to reach out to them.*

15.1.2 Recommendations and proposed actions addressing limited HL in specific aspects and domains of General HL

HL refers to the skills and abilities related to accessing, understanding, appraising, and applying health-related information, and is a necessary precondition for adequate health-related decisions and actions in the domains of health promotion, disease prevention, and health care/treatment. A conceptual matrix consisting of 12 subdomains was used to operationalize the HLS_{19} questionnaire based on its predecessor, the HLS-EU survey questionnaire (see Chapter 1 and Chapter 3).

Each of the subdomains in the matrix was measured with at least one specific item in the HLS_{19} survey. Because of the different interests and prior experience with HL measurement in the 17 countries that participated in the survey, three versions of the questionnaire were used: a 12-item scale (HLS_{19}-Q12) with only one item per subdomain, selected on the basis of the Rasch scalability principle; a 16-item scale (HLS_{19}-Q16) to allow comparison with the older, short form of the HLS-EU; and a 47-item scale (HLS_{19}-Q47). The HLS_{19}-Q47 contains all the items in the HLS_{19}-Q12, while to obtain scores for the HLS_{19}-Q16, ten additional items had to be administered during data collection in addition to the 12 items on the HLS_{19}-Q12. Results of the HLS_{19}-Q12 are available for all 17 countries that participated in the HLS_{19}; the HLS_{19}-Q47 was used by six countries, and the HLS_{19}-Q16 is available for 14 countries. While using versions of different length limits the international comparability of the relevance of specific items, some overall recommendations concerning aspects and domains of HL can still be made:

Independently of the domain (health promotion, disease prevention, healthcare), the four aspects of HL represent a logical hierarchy for processing health-related information.

Recommendation 3: Interventions to improve HL should focus on all four aspects of processing health-related information: accessing, understanding, appraising, and applying information to form judgements and make decisions conducive to health, within the domains of healthcare, disease prevention, and health promotion.

To provide effective health information and communication on any theme, it is necessary to ensure that all aspects of HL are sufficiently supported by interventions.

» *First, ensure the availability of and access to relevant, high quality health information especially through those channels that are typically used by the target group(s) addressed, for example by at-risk groups for low HL (including peer communities and expert peers, neighborhoods, places of worship, social media).*
» *Second, enable the understandability of information for the selected target groups (consider culturally appropriate content, language levels, availability in diverse languages, the information needs of illiterates and people with impaired senses).*
» *Third, enable the appraisability of information by making sure that information sources are given or, preferably, that information that is publicly available is quality assured and that*

people understand well why a certain piece of information is of relevance to them (for example by using the "ask me 3" approach).

» *Fourth, ensure that the information provided is applicable by being clear and detailed enough to guide concrete decisions and actions (for example, by breaking information down into steps).*

In the meantime, a wealth of "how-to" books on these aspects are available. See, for example, DeWalt et al. (2010); Rudd/Anderson (2010); Rudd, Rima E./Anderson, Jennie E. (2006).

15.1.3 Recommendations and proposed actions addressing concrete tasks of General HL

Each of the aspects and domains of HL implies a multitude of tasks involving health-related information and communication. The tasks that were assessed in the HLS_{19} allowed us to identify difficulties concerning HL experienced by larger groups of the general population or by specific (vulnerable) target subpopulations.

While country-specific analysis is recommended as a basis to select tasks to address specific difficulties and develop interventions to improve them, the following table provides an overview of the tasks experienced as being difficult by more than 20% of the respondents in the international sample (see Table 15.1):

Table 15.1:
Average percentage shares for “very difficult” and “difficult” answers to the different HL-related tasks*

	Ordered by task, item no. in the Q47, the HLS_{19} instrument from which the percentages are taken (Q47, Q16, or Q12), and the percentage of “very difficult” and “difficult” answers in the task		
	Health care/treatment (10)*	**Disease prevention (9)***	**Health promotion (12)***
Accessing/ finding (7)*	» Find information on the treatment of illnesses that concern you (CORE-HL2: Q47 26.1%; Q16 23.3%) » Find information on what to do in a medical emergency (CORE-HL3: Q47 24.3%)	» Find information on how to handle mental health problems (CORE-HL18: Q47 36.7%; Q16 36.4%; Q12 36.1%) » Find information on recommended vaccinations (CORE-HL19, Q47 27.9%)	» Find information about changes in laws that affect health (CORE-HL35, Q47 54.3%) » Find out how the neighborhood could become more health friendly (CORE-HL34, Q47 50.4%) » Find information about how to promote health at work, at school, in the neighborhood (CORE-HL36, Q47 38.7%)
Under-standing (5)*	» Understand the instruction leaflets that come with your medicine (CORE-HL6, Q47 27.1%) » Understand information about what to do in a medical emergency (CORE-HL7, Q47 24.3%; Q12 22.7%)	»	» Understand information on food packaging (CORE-HL38, Q47 31.8%) » Understand information in the mass media on how to improve health (CORE-HL39, Q47 28.4%; Q16 26.7%) » Understand information on how to keep your mind healthy (CORE-HL40, Q47 26.3%)
Apprais-ing/judg-ing (9)*	» Judge the reliability of information on illness in the mass media (CORE-HL12, Q47 55%) » Judge the need for a second opinion (CORE-HL11, Q16 44.1%; Q47 42%) » Judge the advantages and disadvantages of treatment options (CORE-HL10, Q47 41.4%; Q12 43%)	» Judge the reliability of information on health risks in the mass media (CORE-HL28, Q47 49.4%; Q16 47.5%) » Judge which vaccinations you or your family need (CORE-HL26, Q47 30.1%) » Judge which health screenings or examinations you should have (CORE-HL27, Q47 29.3%) » Judge when to go to the doctor for a check-up (CORE-HL25, Q47 21.7%)	» Judge how the neighborhood may affect health and well-being (CORE-HL41, Q47 34.7%) » Judge how housing affects health and well-being (CORE-HL42, Q47 22.8%; Q12 22.2%)

	Ordered by task, item no. in the Q47, the HLS19 instrument from which the percentages are taken (Q47, Q16, or Q12) and the percentage of "very difficult" and "difficult answers" in the task		
	Health care/treatment (10)*	**Disease prevention (9)***	**Health promotion (12)***
Applying (8)*	» Use information from the doctor to make decisions about illness (CORE-HL13, Q16 22%)	» Decide how to protect yourself from illness using information in the mass media (CORE-HL31, Q47 43%; Q16 40.8%; Q12 39.7%) » Decide how to protect yourself from illness using information from family or friends (CORE-HL31, Q47 31.2%) » Decide on whether to have the flu vaccination (CORE-HL29, Q47 27%)	» Take part in community activities that improve health and well-being (CORE-HL47, Q47 38.1%) » Influence living conditions affecting health and well-being (CORE-HL46, Q47 32.4%) » Join a sports club or exercise group (CORE-HL45, Q47 27.5%) » Make decisions to improve health and well-being (CORE-HL44, Q12 25.6%; Q47 22.1%)

* The numbers in brackets in the column and row headers refer to the number of very difficult and difficult tasks relating to the HL domain or aspect.

Source: HLS_{19} Consortium

Recommendation 4: When planning interventions related to specific, concrete HL tasks, the tasks that are experienced as being more difficult by study participants should be prioritized.

The subsections below (15.1.3.1 and 15.1.3.2) provide exemplary proposals of interventions that can be considered for difficult tasks related to two topics that are not sufficiently covered in other sections of this chapter, namely HL in relation to the mass media and HL regarding mental health.

15.1.3.1 Improving HL through high quality, appropriate health information in the mass media

As shown by the HLS_{19} results, participants across all countries especially experienced considerable difficulties in judging the trustworthiness of health-related information in the media as well as in understanding and using information conveyed through the media. These findings may be related to the tendency of mass media to draw the public's attention by making information sensational. In relation to health, this can either contribute to unrealistically high hopes for new cures or in unjustified fears for specific health risks or diseases.

Table 15.2:
Tasks in relation to the mass media that were experienced as “difficult” or “very difficult” by more than 25% of respondents

Tasks
» Judge the reliability of information on illness in the mass media (CORE-HL12: Q47 55%)
» Judge the reliability of information on health risks in the mass media (CORE-HL28: Q47 49.4; Q16 47.5%)
» Decide how to protect yourself from illness using information in the mass media (CORE-HL31: Q47 43%; Q16 40.8%; Q12 39.7%)
» Understand information in the mass media on how to improve health (CORE-HL39: Q47 28.4%; Q16 26.7%)

Source: HLS_{19} Consortium

Since the mass media, by definition, reach everybody and thus permeate the whole of society, it is very difficult to try and improve people’s ability to understand, appraise, and apply information from the media through interventions targeted at individuals, and efforts to do so would be ineffective.

Recommendation 5: The quality of health information in the mass media should be improved and guaranteed on systemic and organizational levels.

Therefore, interventions on systemic and organizational levels would make more sense.

Systems-level actions proposed for potential interventions:

» *Aim at a national media strategy to improve the quality of information either by specific regulations or based on voluntary improvements in the quality of health information, including illicit and overt health messages.*
» *A national media strategy may involve incentives like a media prize for trustworthy health information.*
» *Since the ability to judge information from the mass media is strongly related to general education, media health literacy (MHL), and critical media literacy, it may make sense to include this topic in school curricula.*
» *In addition to media HL, it might be worthwhile investing in a national health information portal covering aspects of health care, disease prevention, and health promotion, as well as in a strategy for making the portal known both to relevant expert stakeholders and the general public (see also Subsection 16.2.3).*
» *It may also make sense to establish quality standards for health information that should be followed by those developing, commissioning, or distributing publicly available health information (see also Subsection16.2.3).*

Organizational-level proposals (for media organizations):

» *Have a policy on timely, relevant, and transparent health information.*
» *Have organizational guidelines on how to research, develop, and provide health information in clear language.*

Individual-level actions:

» *Media-related HL and the dissemination of trustworthy health information channels can be supported through training and interventions by continuous education centers, healthy communities, community and occupational health services, and many more local actors that can be included in national strategies.*

15.1.3.2 Improving HL in relation to mental health

The HLS_{19} questionnaires did not contain many questions related to mental health. The few items on mental health that were used in the survey showed that finding information on mental health was difficult for one out of every three respondents while understanding information on how to maintain good mental health was difficult for one out of every four respondents.

Due to the Covid-19 pandemic, among other things, international experts and organizations are warning that mental health issues will be on the rise in the near future. Supporting mental HL in the fields of promotion and prevention may help reduce the burden of disease in this field. Mental HL around treatment may encourage people to seek treatment in a timely way and add to the effectiveness of services.

Recommendation 6: Focusing on mental HL and interventions to improve HL in relation to mental health should be prioritized and supported by specific research.

15.2 Recommendations and proposed actions for specific health literacies

Within the HLS_{19} Project, new tools were developed for collecting information on four specific health literacies via optional packages that could be selected by participating countries.

» Navigational HL was measured in eight (ten) countries: AT, BE, CH, CZ, DE, FR, PT, SI, (BG*, NO*),
» Communicative HL was measured in nine (ten) countries: AT, BE, BG, CZ, DE, DK, FR, HU, SI, (NO*),
» Digital HL was measured in 13 countries: AT, BE, CH, CZ, DE, DK, FR, HU, IE, IL, NO, PT, SK,
» Vaccination HL was measured in 11 countries – of these, seven countries used the complete optional package (AT, BE, CZ, HU, IE, PT, and SI) and a further four countries used the vaccination items from the HLS_{19}-Q47 (BG, DE, IT, and NO).

* Not all of the items of the HL measure were implemented and therefore no comparable score was possible.

In the following paragraphs, recommendations and proposed actions pertaining to these specific health literacies are provided in the order of number of countries that assessed the specific health literacies.

15.2.1 Navigational HL

An instrument for measuring Navigational HL was developed and fully applied in eight European countries for the first time. Overall, the Navigational HL tasks are perceived as challenging, although with considerable variation among countries. The Average Percentage Response Patterns (APRP) for "(very) difficult", with an average of 45%, ranged from 33% (AT, SI) to 59% (DE). Like General HL, Navigational HL follows a social gradient: a lower social status/level in society and lower financial resources are linked to lower Navigational HL in most countries. Concerning specific tasks, navigating healthcare systems, and finding support for orientation in the system is perceived as (very) difficult by many patients/users (total: 47.6%). Especially information tasks on the systemic level (about the structure and functioning of the healthcare system) and concerning health care organizations were perceived as (very) difficult, indicating that those structures form a "black box" (Gui et al. 2018b) for many patients/users. Respondents viewed it especially as (very) difficult to understand information about current health care reforms that may affect their health care situation (total: 56.6%), to judge whether a particular health service would meet their expectations (total: 52.0%), to find information about patients'/users' rights in the healthcare system (total: 51.6%), and to find information on the quality of health services (total: 48.8%). Furthermore, having low Navigational HL does not remain without consequences: the HLS_{19} study found a relationship between Navigational HL and indicators for health and health care utilization in some countries.

Recommendation 7: Health policy should develop strategies to improve people's Navigational HL, especially focusing on population groups which experience more problems for this type of competence. Specifically, to improve Navigational HL, interventions on systemic and organizational levels should be developed and implemented with the aim of making the health system more health-literate, user-friendly, and easier to navigate.

Systems interventions:

» *On a general level, more transparency, clarity, and user-friendliness for healthcare systems as well as more comprehensibility and plausibility about health care reforms and their relevance/effects on the residential population (or on specific subgroups) are needed.*

» *Overall, decision makers need to be made aware of the level of difficulties that people experience when attempting to navigate and use the healthcare system. Agenda-setting should focus on effective strategies for improvements on the systemic level, with specific emphasis on*

  » *making healthcare systems, including insurance companies, more transparent and user-friendly in the sense of health-literate healthcare systems and health care organizations (HLO) (if necessary, by legal regulations),*

  » *making it easy to find the right contact in health care organizations/professions at the right time by providing easily accessible and trustful guidance systems (using easy-to-understand signage systems) and pathways (of care) through the healthcare system in the form of specific programs),*

- » *improving pathways to health information and services by involving users in redesigning these pathways to meet their needs,*
- » *strengthening especially the availability and understandability of information about what to expect from services, the quality of services (in those cases where people have the choice between services), and how to ensure patients' rights,*
- » *training key staff in supporting patient navigation.*

» *Alliances should be sought to support Navigation HL also through cooperation with other sectors (for example, by including education about the general functioning of national healthcare system in school curricula; by providing essential health information via occupational health services).*

Organizational-level interventions (compare e.g., Rudd, Rima E./Anderson, Jennie E. (2006)):

» *Train staff to help clients/visitors find their way around in complex health care institutions.*
» *Use orientation systems (signage, guidance systems, etc.).*
» *Involve visitors/patients in improving the orientation system, for example by walking interviews for the accreditation of health literate organizations.*
» *Involve user/patient organizations to support people in navigation. User/patient organizations could also be involved in the development of health literate organizations.*

Individual-level interventions:

» *Develop and offer training about the general functioning of the healthcare system, how to navigate the system, and how to advocate one's own patients' rights.*
» *Support people with higher risks of low Navigational HL such as people with chronic illnesses who may need specific guidance from patient navigators, care or case management along the entire illness, and health care trajectories.*

15.2.2 Communicative HL: Communicating with physicians

While the HLS-EU already contained some items on Communicative HL, the HLS_{19} included a specific optional package for Communicative HL with physicians, which came as either a long or a short version of this specific scale (the HLS_{19}-COM-Q11 and the HLS_{19}-COM-Q6). It was intended to measure Communicative HL in dialogue with health professionals in general. However, during pretesting, the general term "health professionals" was not well accepted by the participants. Because the participants' experiences differ depending on the kind of health professional, the term was perceived to be too vague, which made it difficult to have an opinion and answer the questions. In addition, the status of different health professions varies widely across the participating countries while that of physicians is quite similar and comparable. Therefore, the group decided to focus on physician-patient communication.

For the various items in the HLS_{19}-COM-Q11, the percentage of perceived difficulty for the total sample ranged from 4.4% (HL-COM1: describe to your doctor your reasons for coming to the consultation) to 25.3% (HL-COM4: get enough time in the consultation with your doctor). For the HLS_{19}-COM-Q6 items, they varied from 9.2% (HL-COM3: explain your health concerns to your doctor) to 26.2% (HL-COM4: get enough time in the consultation with your doctor). General HL was the strongest predictor of Communicative HL. Communicative HL was lower for lower socio-economic status (social status/level in society and financial deprivation) and for poorer health, confirming a "social gradient" in doctor-patient communication. Older people, people with a very low educational level, those with a low level in society, the financially deprived, those with a poorer health status, and those reporting frequent use of health care were found to be specifically prone to low Communicative HL. Although a mixed pattern of the consequences of Communicative HL was observed across the participating countries, low Communicative HL does appear to be linked to poorer self-reported health and to more frequent utilization of healthcare services in most countries. Associations were also found between Communicative HL and health behavior and at least one health status indicator in most countries.

Concerning the specific Communicative HL tasks, most respondents found these comparably easy in relation to the other specific health literacies. Most difficulties were encountered in getting enough time in the consultation with doctors (difficult for 1 in 4 respondents) and in expressing personal views and preferences to the doctor. Between 10% (AT and SI) and 27% (DE) of respondents reported difficulties in communicating with their physicians. Communicative HL with physicians is relevant for the outcomes of health care services.

Recommendation 8: Interventions to improve the communication of health professionals with patients should have high priority in health policy and practice. Specifically, interventions to support health professionals, especially physicians, in dedicating more time to person-centered communication are needed.

Proposed actions for potential interventions:

- *Healthcare systems should be improved to*
  - *support health professionals in dedicating more time to person-centered communication and information to be able to better facilitate active patient participation in the conversation and when negotiating their health care, by better financial remuneration for the time needed for communication,*
  - *organize healthcare to better enable and facilitate communication and information, for example by having specific health professionals (e.g., advanced nurses) supporting communication processes, in addition to good communication with physicians,*
  - *make high-quality, evidence-based communication and information training an integrated part of professional training and the continuous education of healthcare professionals,*
  - *National action plans on HL that include a focus on Communicative HL can be an important tool to facilitate implementation and dissemination (see, for example, the Austrian policy for establishing a patient-centered culture of communication "Improving the Quality of Healthcare Communication" (Nowak/Sator 2017)).*
- *Healthcare organizations should be encouraged to adopt organizational HL/responsiveness including a focus on supporting high-quality patient-centered communication:*

    - *Specifically, the management of health care services should support communication training for all health professionals working for the organization,*
    - *Communication training should also focus on ensuring good communication with socio-economic disadvantaged people and those with chronic diseases,*
    - *Supplementary education should be offered for physicians in communication and counselling.*

- *Support to individuals can provide specific support for those who need it:*
    - *Support Communicative HL through training and the empowerment of patients/users, especially those with chronic illness or multimorbidity and people with low socio-economic resources (e.g., certain migrant communities, people with low formal education) to support active participation (e.g., Ask me 3, question prompting),*
    - *Include nonprofessional health workers/mediators (lay people with special training) as specific support for vulnerable populations to improve communication in consultations (e.g., (Katona et al. 2021) and to support the management of communication/information management over the course of an illness,*
    - *Offer services in different languages and/or adequate translation services for people not proficient in the local language (e.g., via video translation).*

- *Collaborate with other sectors, especially with education, to foster knowledge and skills on how to express oneself about health and disease from an early age on.*

15.2.3 Digital HL

Digital health is an important facilitator of self-care and the use of healthcare services, adopting healthy lifestyles, and participating in the early detection of health problems. Accordingly, , by encompassing a set of critical skills for empowerment in health and well-being, Digital HL is becoming increasingly important. It is specifically defined in the HLS_{19} as the ability to search for, access, understand, appraise, validate, and apply online health information, the ability to formulate and express questions, opinions, thoughts, or feelings when using digital devices, taking into account the frequency with which people use different digital sources and resources such as online video consultations, digital personal health records, social media, and health related apps, etc. for promoting health. The HLS_{19} provided the first international assessment of Digital HL for 13 countries in the WHO European Region.

In the HLS_{19} study, three aspects of Digital HL were measured: the frequency of use of digital tools to access information on health; the perceived ease or difficulty to find, understand, appraise, and apply health information from digital sources, and on-line interactivity regarding health issues. The results of the HLS_{19} revealed that digital tools are widely used to access health-related information but that in all but three participating countries it is less frequently used to interact with the healthcare system itself. Overall, more than 25% of the total population reported difficulties using digital devices to process health information, with huge variation among countries, ranging from 11% (PT) to 48% (SK).

About a third of the respondents found it difficult to very difficult to find, understand, evaluate, and apply digitally available health information (2%–18% of respondents found it “very difficult”, and a further 20%–40% “difficult”). The distribution differed across participating countries, with only one in five of the Norwegian respondents (22%) experiencing the tasks as being difficult or very difficult, as opposed to three out of every five German respondents (58%).

Regarding specific tasks, respondents found it most difficult to judge whether information is offered with commercial interests and to judge whether information is reliable.

General HL and Digital HL are strongly associated. Furthermore, Digital HL is positively associated with high education, low financial deprivation, and younger age categories, although there were exceptions in some countries (see Chapter 12 for details).

The degree to which Digital HL predicts selected outcome measures was highly variable across participating countries. This probably indicates different levels of development in the process of digitalizing health care: the more digitalized health care in a country is, the stronger the impact of the Digital HL score is expected to be. Digital development is most likely to increase over the next years.

Recommendation 9: Emphasis on easily accessible, high quality, trustworthy, understandable, assessable, and applicable health information as well as communication via digital sources should be increased.

Proposed actions for potential interventions:

Systems-level interventions:

» *Introduce regulations and incentives for good-quality and appropriate digital health information, resources, and communication systems.*
» *Set up public online health portals (for the general public, for healthcare professionals, for journalists) to provide essential health information free from commercial interests (nationally, or via national/regional healthcare providers), including information on seasonally relevant health topics.*
» *Carry out research on the preferred information and communication channels for specific vulnerable target groups (including social media) to create matching strategies to support Digital HL.*
» *Include public participation when developing online interventions to determine policy on digital health.*

Organizational-level interventions:

» *Support healthcare providers to improve the availability and user-friendliness of their digital services including digital options for making appointments, innovative tools such as chatbots, and acknowledging the need for cultural appropriateness.*

» *Provide training for healthcare providers to empower groups in acclimatizing to a digital system, without stigma regarding ability according to age, etc.*
» *Update health literate organization standards and attributes to include Digital HL.*

Individual-level interventions:

» *Provide training on critical Digital HL (how to recognize and scrutinize fake news and commercial interests) for example, through school curricula, continuing education centers, and skill building through social media avenues.*
» *Facilitate access to digital devices for financially deprived groups (for example, via public libraries, community centers, primary healthcare centers).*
» *Offer specific training in digital skills on the local level (for example, via senior clubs, centers for adult learners).*

15.2.4 Vaccination HL

High confidence in vaccination programs is crucial for maintaining high coverage rates. However, over the past few years, there has been a decline in the general public's confidence in vaccines, resulting in an increasing number of vaccine delays and refusals. This, in turn, contributes to declining immunization rates and increases in disease outbreaks in several countries, as illustrated by recent measles outbreaks. As such, vaccination hesitancy has become a major concern for public health authorities. This concern became even more pressing with the Covid-19 pandemic. Although there is a consensus among experts that vaccination of the population is by far the most (and probably the only) effective strategy to curb the pandemic, doubts about the safety and effectiveness of the vaccines against the SARS-CoV-2 virus are rampant in large groups of the population. As such, this is an even more relevant topic than before and a much-debated issue.

Several studies have documented that health literacy, or its more specific form of Vaccination Literacy, may play an important role in vaccination hesitancy. More specifically, Vaccination HL can be regarded as a potential moderator of complacency and/or confidence issues and might, as such, contribute to counteracting the negative effects of exposure to misleading information on vaccinations. However, to date no national surveys have included measures of vaccination behavior and its determinants (attitudes, trust, knowledge, groups, and social norms) along with refined measures of functional, communicative, and critical HL to clarify the role of the latter in vaccination behavior.

The HLS_{19} study is the first to provide an international assessment of Vaccination HL in the WHO European Region. Eleven countries measured this type of HL. The results show that dealing with information about vaccination is difficult for a major proportion of respondents in all countries, although the size varies among countries (13% for PT to 45% for BG). Judging or assessing information on vaccination was experienced as the most difficult aspect. Like General HL and other specific forms of HL, Vaccination HL is lower for people with lower socio-economic status. In contrast, age, gender and – surprisingly – being trained in a health profession are not consistently correlated with Vaccination HL. The latter implies that not only lay people but also people working in healthcare can be relevant target groups for interventions to improve Vaccination HL.

In all participating countries (except for PT), Vaccination HL is a relevant determinant of reported vaccination behavior.

Recommendation 10: Improving Vaccination HL should have top priority, with a special focus on the vulnerable groups identified. The aspect of judging information on vaccination (as opposed to finding, understanding, or applying it) should be prioritized to improve the trustworthiness of information and communication regarding vaccination.

Proposed actions for potential strategies that may improve Vaccination HL and particularly resistance to false information:

Systems-level interventions

» *Provide easily accessible, understandable, trustworthy, and quality-assured public information on vaccination and vaccination services for the general public, especially via the internet and on social media. Consider the potential of innovative information tools such as chatbots but also consider specific information needs and preferred, culturally appropriate information channels for selected, hard-to-reach groups (jointly developed with the target groups, in different languages).*
» *Communicate better about the role of relevant institutions and organizations, such as the Food and Drug Administration (FDA) or the European Medicines Agency (EMA) and provide transparent information about vaccine approval processes.*
» *Communicate clearly and openly about the potential benefits AND risks of vaccinations, for example by using fact box formats. For the dissemination of information, it may make sense to establish partnerships with relevant actors in health and other sectors, including community care and occupational health services, education (school curricula), the media (journalists, influencers), and NGOs representing diverse parts of civil society.*
» *Focus on strengthening the confidence of health professionals in vaccinations: They are the ones conveying information to the public. Therefore, it would make sense to*
    » *better understand what makes health professionals skeptical and what information they need, for example, via focus groups,*
    » *invest in vaccination-related training and further education for healthcare staff,*
    » *provide guidelines and contact points for health professionals in charge of vaccination programs.*

Organizational-level interventions (for centers and institutions providing vaccinations)

» *Have a policy on staff training about vaccination to ensure coherent messages to vaccinees.*
» *Prepare staff to answer questions from vaccinees.*
» *Have high-quality information material available on vaccinations.*

Individual-level interventions:

» *Offer training and information on vaccination for interested individuals (for example, online talks by medical experts, courses in community or senior centers, at places of worship).*
» *Involve representatives of target groups in the development of information on vaccination: This may help to identify topics people might be specifically interested in, such as the ingredients in vaccination products, the risk of vaccination injuries, etc. The relevant information should be made available transparently and via trusted sources so as not to fuel conspiracy theories and false information.*

15.3 Recommendations and actions proposed for research

The HLS_{19} results have demonstrated the relevance of HL for population health and health policy by identifying overarching general trends in the results while also revealing considerable variations in the results across participating countries.

Recommendation 11: The HL of the adult resident population should be measured regularly in as many countries in the WHO European Region as possible. The next wave of measuring should be planned for data collection in 2024.

Proposed actions: Besides the measurement of HL in the adult population, the measurement of HL in children and adolescents should be considered.

Proposed actions: Besides the measurement of general and specific personal HL, research on intervention research/action research to improve HL should be supported.

Proposed actions: Besides the measurement of general and specific personal HL, the measurement of organizational HL should be supported.

For numerous reasons, including the Covid-19 pandemic, the HLS_{19} was less standardized than originally planned. Since different methods of data collection were applied, differences in results between countries can only be interpreted with caution. There is, however, an ongoing transformation in the techniques of data collection, albeit at differing speeds across countries.

Recommendation 12: In preparation for the next wave of the survey, more specific research should be funded to extend and apply the tool for measuring General HL and relevant correlates. This should include more detailed, specific analyses and publications of the HLS_{19} data. On the basis of the validation results, the wording of some items should probably be revised.

Proposed actions: The implementation, intervention, and action research for improving limited General HL should be stipulated.

The HLS_{19}-Q47 allows for a more comprehensive analysis of the task-related difficulties encountered by respondents than the HLS_{19}-Q12 or the HLS_{19}-Q16.

Recommendation 13: Especially countries measuring population HL for the first time should use the HLS_{19}-Q47, which will best support the selection of country-specific difficulties and interventions responding to these difficulties.

Countries that have more experience with the survey can combine the shorter versions with the scales for the specific health literacies that complement the assessment of General HL.

For all four specific HLs (Navigational HL, Communicative HL, Digital HL, Vaccination HL) included in the HLS_{19}, the assessment tools were developed and used for the first time in the HLS_{19}.

Recommendation 14: For the four specific HLs, more detailed analyses and publications on the HLS_{19} data as well as further research and development on improvements for later applications are needed. More specific correlates, determinants, and consequences of specific HLs should be considered, selected, and tested.

Proposed actions: The implementation, intervention, and action research for improving limited specific HL should be stipulated.

Alongside those specific health literacies that were assessed in the HLS_{19}, which partly followed specific types of HL-related tasks, and which, in the case of vaccination, focused on one specific aspect of prevention, other important fields of HL maybe of interest for health policy makers.

Recommendation 15: Additional specific health literacies or relevant topics of General HL should be reviewed, selected, and researched to be included in the next wave of HLS.

Proposed action: Health research institutes should be encouraged to include HL research in their research agendas.

Proposed action: It might be worthwhile to undertake research into HL related to specific chronic diseases or conditions.

Recommendation 16: More detailed analyses are needed regarding the costs and economics of General HL and of the four specific HLs studied in the HLS_{19}. Further dissemination of the results of the HLS_{19} through peer-reviewed scientific publications is required, as is further research and development into how to improve the survey for future applications.

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