



Original Research

Pathways of how health literacy and social support are associated with health outcomes in 17 European countries: Results of mediation analyses

Orna Baron-Epel^{a,*}, Thomas Link^b, Robert Griebler^c, Henrik Bøggild^d, Eva-Maria Berens^e, Éva Bíró^f, Deirdre Coy^g, Saskia Maria De Gani^{h,i}, Doris Schaeffer^e, Kristine Sørensen^j, Christopher Le^k, Maria Lopatina^l, Gillian Rowlands^m, Rajae Touzani^{n,o}, Stephan Van den Broucke^p, Ferenc Vincze^f, Mitja Vrdelja^q, Sanja Vrbovsek^r, Diane Levin-Zamir^s

^a School of Public Health, University of Haifa, Israel

^b Department of Quality Measurement and Patient Survey, Austrian National Public Health Institute, A-1010, Vienna, Austria

^c Competence Centre Health Promotion and Healthcare, Austrian National Public Health Institute, A-1010, Vienna, Austria

^d Public Health and Epidemiology, Aalborg University, Denmark

^e Bielefeld University, Bielefeld, Germany

^f University of Debrecen, Faculty of Medicine, Department of Public Health and Epidemiology, Hungary

^g Department of Health, Ireland

^h Careum Center for Health Literacy, Careum Foundation, 8032, Zurich, Switzerland

ⁱ Careum School of Health, Kalaidos University of Applied Sciences, Department Health, 8006, Zurich, Switzerland

^j Global Health Literacy Academy, Denmark

^k Inland Norway University of Applied Sciences, Faculty of Social and Health Sciences, Department of Health and Nursing Sciences, Norway

^l National Medical Research Center for Therapy and Preventive Medicine Under the Ministry of Health of the Russian Federation, Russia

^m Public Health Sciences Institute, Newcastle University, United Kingdom

ⁿ Aix Marseille Univ, INSERM, IRD, ISSPAM, SESSTIM, Sciences Economiques & Sociales de la Santé & Traitement de l'Information Médicale, Equipe CANBIOS Labellisée Ligue 2019, Marseille, France

^o Institut Paoli-Calmettes, SESSTIM, U1252, Marseille, France

^p Université Catholique de Louvain, Belgium

^q National Institute of Public Health, Ljubljana, Slovenia

^r National Institute of Public Health – NIJZ, Slovenia

^s School of Public Health, University of Haifa, Clalit Health Services, Tel Aviv, Israel

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ABSTRACT

Objectives: To estimate and compare (1) how social support (SS) acts as a mediator for the association between health literacy (HL) and health outcomes, and (2) how HL acts as a mediator for the association between SS and health outcomes.

Study design: Mediation analyses.

Methods: Data from the Health Literacy Survey 2019 (HLS₁₉) were analyzed including 42,445 participants in 17 European countries. Four mediation models were tested with two health outcomes: self-reported health (SRH) and health-related limitations (Global Activity Limitations Indicator, GALI). In two models, SS was the mediator between HL and SRH and in the other two models HL was the mediator between SS and GALI.

Results: SS is a significant mediator of the association between HL and SRH in all countries and between HL and GALI in eight countries. Up to 25–30 % of the total effect was mediated by SS. In addition, HL is a significant mediator of the association between SS and SRH in 15 countries and between SS and GALI in eight countries.

* Corresponding author. University of Haifa, School of Public Health, Abba Khosh 199, Haifa, Israel.

E-mail addresses: ornaepel@research.haifa.ac.il (O. Baron-Epel), thomas.link@goeg.at (T. Link), robert.griebler@goeg.at (R. Griebler), boggild@hst.aau.dk (H. Bøggild), eva-maria.berens@uni-bielefeld.de (E.-M. Berens), biro.eva@med.unideb.hu (É. Bíró), Deirdre.Coy@health.gov.ie (D. Coy), saskia.degani@careum.ch (S.M. De Gani), doris.schaeffer@uni-bielefeld.de (D. Schaeffer), contact@globalhealthliteracyacademy.org (K. Sørensen), christopher.le@inn.no (C. Le), ms.lopatinamaria@yandex.ru (M. Lopatina), gill.rowlands@newcastle.ac.uk (G. Rowlands), rajae.touzani@inserm.fr (R. Touzani), stephan.vandenbroucke@uclouvain.be (S. Van den Broucke), vincze.ferenc@med.unideb.hu (F. Vincze), mitja.vrdelja@nijz.si (M. Vrdelja), sanja.vrbovsek@nijz.si (S. Vrbovsek), diamos@zahav.net.il (D. Levin-Zamir).

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With regard to SRH, SS may be regarded as the more relevant mediator between HL and SRH; whereas for GALI, HL can be considered the mediating factor between SS and GALI, as the proportions mediated were higher in the respective models in most countries.

Conclusions: Both HL and SS may serve as significant mediators in the models of both health measures, but to different extents. Planning interventions to mutually improve SS and HL may help communities improve health.

1. Introduction

Early and recent research suggests that health literacy (HL) is significantly associated with various health outcomes.^{1,2} Many definitions have been provided for HL, this study is based on the comprehensive definition adopted by the study Health Literacy Survey 2019 (HLS₁₉) in which this study is nested: “Health literacy 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.”³ Research and discussion on the topic have consistently suggested that the social context of HL is central to the effect of HL on health and its operation.⁴

HL can be regarded as both a social and individual determinant of health; this influence can be direct and/or indirect.^{5,6} Other determinants of health may interact with HL and health, explaining the complex ways in which health is achieved.⁷ Pelikan et al.⁶ suggested that HL can be regarded mostly as a direct independent determinant of health. Alternatively, it has been suggested⁵ that HL is a determinant of health that responds to intervention, and HL itself may serve as a mediator for the social determinants of health. Therefore, improving HL may reduce inequalities in health.

There are two possible mediation pathways between health, HL and additional social determinants of health. First, social determinants of health can mediate the association between HL and health. Secondly, HL may serve as a mediator between other determinants of health and health outcomes.

Understanding the associations between HL, health, and other determinants of health can help to systematically plan interventions to improve health.^{2,5,6}

In this context, SS is a social determinant of health that has been extensively studied and shown to predict or be associated with various measures of health.^{8–11} It stems from interpersonal relationships and interactions within one’s social network.^{12–14}

While both SS and HL are important determinants of health, the complexity of this association is not clear. An emerging question is the nature of the relationship between SS and HL, and how they in turn together influence health outcomes.

Relatively recent studies testing the associations between HL, SS, and health outcomes found HL to be associated with SS in different countries and different populations.^{15–23} Overall, individuals with higher levels of HL reported higher levels of SS^{19,21,22} and this depended on age.²³ However, some studies did not find this association.^{18,20} The mediation effect of SS on the association between HL and health outcomes was tested and found to be significant in a few studies.^{17,22} In another study from Hungary, Biro et al.²¹ tested SS as a mediator for socioeconomic factors and HL and found SS was a significant mediator. Recently, in another study, HL was tested as a mediator between socioeconomic status and health in Belgium. HL partially mediated the relationship between education and health behavior, perceived health status and mental health status.²⁴

HL may also serve as a mediator between SS and health. Shih et al.¹⁶ tested HL as a mediator between two types of SS, HL had a significant mediating effect on social exchange and depression, but not on emotional support. In other studies, the mediation was not tested as such, even though they measured the associations between these variables. In one study the association between SS and HL was not

significant.²⁵

Since most of these studies were performed in Eastern Asia, it is not clear if this can be generalized to all communities and western cultures.

Recent scholars suggest that social skills (for example, the ability to interact and get support from others) are a specific type of individual HL⁴ and designated by some as ‘distributed health literacy’.^{26,27} Muscat et al.²⁷ reviewed the literature regarding distributed HL. They suggest that there is a need to define the difference between general SS and support that compensates for low individual HL. In our present study we conceptualize that SS is a distinct measure and not regarded as part of HL, however they are associated with each other.

The Health Literacy Survey 2019 (HLS₁₉), a project of the World Health Organization (WHO) European Region Action Network on Measuring Population and Organizational Health Literacy (M-POHL) applied an instrument (HLS₁₉-Q12) that measured general HL in 17 countries in Europe²⁸ between 2019 and 2021. In all countries, HL was associated with various measures of health after adjusting for socioeconomic measures.²⁹

The objective of this study was to test four models of mediation in 17 European countries based on the above-mentioned M-POHL HLS₁₉ project. Fig. 1 describes the pathway for SS mediating the association between HL and two health measures. Fig. 2 describes the pathway for HL as the mediator between SS and the two health measures. This exploration can shed light on how HL and SS influence health.

2. Methods

2.1. Setting

This study applied a secondary analysis of the Health Literacy Survey 2019 (HLS₁₉) data of M-POHL. The HLS₁₉ was a multi-center multi-stage random sampled cross-sectional survey study involving 17 European countries.^{29,30} Data were collected between November 2019 and June 2021. The study population was defined as all permanent residents aged 18 and above in the participating countries, resulting in a total of 42,445 responses. A more detailed description of the study design and validation of the recall instrument has been published elsewhere.²⁹

2.2. Explanatory variables and outcome measures

The study measured general HL using the validated HLS₁₉-Q12p questionnaire, a 12-item short form questionnaire of the HLS₁₉-Q47. This questionnaire was designed to measure comprehensive, general HL in adult populations.²⁸ A sum of the 12 item’s numeric values was

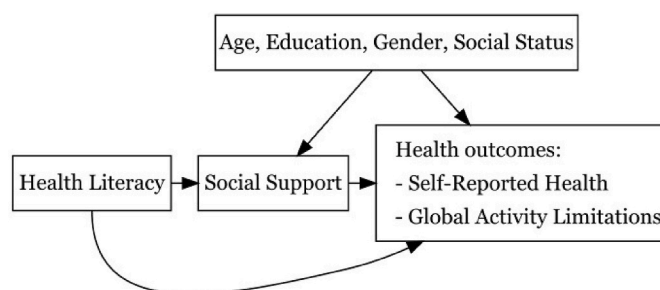


Fig. 1. Social support as a mediator between the health literacy and health outcomes, models SRH1 and GALI1.

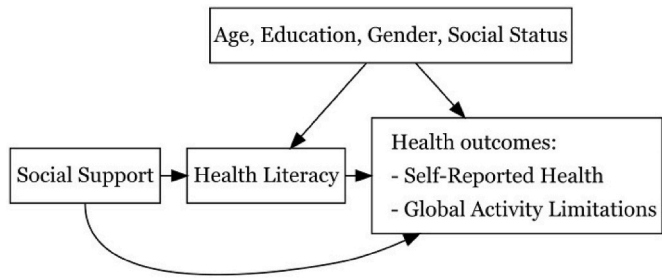


Fig. 2. Health literacy as mediator between the health literacy and health outcomes, models SRH2 and GALI2.

calculated and scaled to a range from 0 to 100 where a higher score reflects better HL.

Social support was measured by the Oslo Social Support Score. It ranges from 3 to 14, with a higher score indicating stronger support.^{31,32}

Health outcomes were measured using two questions: self-reported health (SRH) and Global Activity Limitations Indicator (GALI). SRH was assessed with one question and the answer was dichotomized into good health (1 = “very good” or “good”) and poor health (2 = “not good and not bad”, “bad” or “very bad”).³³ GALI was measured with one question and dichotomized into not limiting at all (numeric value 1) or limiting (2 = “severely limiting” or “limiting but not severely”).³⁴

Personal and sociodemographic measures included: gender (male/female), age, highest level of education and financial deprivation.

These variables are described in more detail in the International Report on the Methodology.²⁹

2.3. Statistical analysis

Distribution of variables were described with mean and standard deviation (SD) or proportions, correlation between variables with Pearson correlation and polyserial correlations for dichotomous outcomes.

Four mediation models were analyzed as shown in

Label	Predictor	Mediator	Outcome
SRH1	HL	SS	SRH
GALI1	HL	SS	GALI
SRH2	SS	HL	SRH
GALI2	SS	HL	GALI

The models are depicted in Figs. 1 and 2. Mediation was estimated as the average causal mediation effect (ACME control) and the proportion mediated through SS or HL in two models, one for SHR and one for GALI, while controlling for gender, age in years, education, and financial deprivation (Figs. 1 and 2). All analyses were conducted separately by country. For tests of “statistical significance”, the conventional $\alpha = 0.05$ level was used.

Statistical analyses were done in R.³⁵ Polyserial correlations were calculated using the polycor package.³⁶ The mediation analysis was conducted using the mediate function of the mediation R package³⁷ using 1000 Monte Carlo draws for a quasi-Bayesian approximation with heteroskedasticity-consistent standard errors. The random seed was set beforehand.

3. Results

This study tested the association between the determinants of health, HL and SS and two health outcomes (Figs. 1 and 2). Table 2 presents the ranges of the variables in the 17 European countries.

The correlations between these variables were tested (Table 1). The correlation between HL and SRH was statistically significant in all countries. The correlation between HL and limiting health (GALI) was

Table 1
The correlation between general health literacy, social support, self-reported health and limiting health (Pearson and polyserial correlations).

Countries	HLS19-Q12p score* social support score Pearson	HLS19-Q12p score* SRH Polyserial	HLS19-Q12p score* GALI Polyserial	Social support score * SRH Polyserial	social support score * GALI Polyserial
AT	0.182***	−0.214***	0.127***	−0.264***	0.193***
BE	0.183***	−0.290***	0.144*	−0.275***	0.203**
BG	0.344***	−0.295***	0.149**	−0.288***	0.204***
CH	0.237***	−0.200***	0.200***	−0.295***	0.154***
CZ	0.290***	−0.099**	0.072*	−0.155***	0.083*
DE	0.179***	−0.279***	0.187***	−0.226***	0.160***
DK	0.298***	−0.285***	0.162***	−0.318***	0.171***
FR	0.216***	−0.249***	0.045	−0.276***	0.134***
HU	0.245***	−0.239***	0.161***	−0.184***	0.138**
IE	0.210***	−0.190***	0.153***	−0.087**	0.086**
IL	0.194***	−0.157***	0.014	−0.295***	0.058
IT	0.254***	−0.258***	0.187***	−0.298***	0.109***
NO	0.188***	−0.158***	0.080**	−0.233***	0.150***
PT	0.192***	−0.310***	0.415***	−0.261***	0.242***
RU	0.273***	−0.350***	0.264***	−0.253***	0.136***
SI	0.203***	−0.328***	0.243***	−0.211***	0.140***
SK	0.246***	−0.284***	0.266***	−0.229***	0.144***

***<0.001, **<0.01, *<0.05.
AT = Austria, BE = Belgium, BG=Bulgaria, CH = Switzerland, CZ = Czech Republic, DE = Germany, DK = Denmark, FR = France, HU = Hungary, IE = Ireland, IL = Israel, IT=Italy, NO = Norway, PT = Portugal, RU=Russia, SI=Serbia, SK = Slovakia.
GALI = Global Activity Limitations Indicator, HLS19-Q12p = general health literacy, SRH = Self-reported health.

statistically significant in all countries except for France and Israel. In all countries, HL was significantly associated with SS. SS is associated with SRH in all countries, and with limiting health (GALI) in all countries except Israel.

Four mediation models were analyzed for each country, two models for SRH (SRH1, SRH2) and two models for GALI (GALI1, GALI2) as the measures of health. Two models were tested with SS as the mediator between HL and health (SRH1, GALI1), and another two with HL as the mediator between SS and health (SRH2, GALI2).

3.1. SRH models

Table 4 presents the mediation models with SRH as the health outcome. The proportion of the association between HL, SS and SRH, the Average Causal Mediated Effect (ACME), and its *p*-value for each country are presented.

SS is a significant mediator between HL and SRH in all countries (SRH1 model). In 14 countries the *p*-value was <0.001. In seven countries the proportion mediated is above 0.2 suggesting 20 % of the association is mediated by SS.

When testing the alternative model (SRH2 model) where HL is the mediator between SS and SRH, HL was found to be a statistically significant ($p \leq 0.05$) mediator in 15 of the 17 countries. In CZ and PT, the mediation is not significant. In only two countries the proportion mediated was above 0.2.

When comparing the proportion mediated in the model with SS as the mediator (SRH1) and the model with HL as the mediator (SRH2), the proportion mediated is higher in 12 countries. In four countries the proportion mediated is higher in the model with HL as the mediator (SRH2) compared to the model with SS as the mediator (SRH1).

3.2. GALI models

Table 3 presents the mediation models with GALI as the health

Table 2

Mean and standard deviation (SD) of age, general health literacy, social support, proportion with good self-reported health and proportion with limiting health in 17 European countries.

Country	Sample size	Age Mean ($\pm$ SD)	HLS19-Q12p score Mean ($\pm$ SD)	Oslo social support score Mean ($\pm$ SD)	Good Self -Reported Health %	Limiting Health GALI %
AT	2967	52.31 ($\pm$ 16.43)	71.61 ($\pm$ 13.62)	11.58 ($\pm$ 1.84)	81.67 %	35.62 %
BE	1000	47.82 ($\pm$ 16.11)	59.39 ($\pm$ 16.96)	9.52 ($\pm$ 2.20)	57.70 %	74.84 %
BG	865	40.47 ($\pm$ 14.58)	61.97 ($\pm$ 13.97)	10.74 ($\pm$ 1.76)	70.77 %	36.47 %
CH	2502	50.01 ($\pm$ 17.69)	65.21 ($\pm$ 13.28)	10.40 ($\pm$ 2.12)	80.83 %	39.80 %
CZ	1599	49.37 ($\pm$ 17.33)	64.38 ($\pm$ 14.12)	9.51 ($\pm$ 2.05)	58.57 %	51.94 %
DE	2143	51.76 ($\pm$ 18.17)	59.35 ($\pm$ 13.61)	10.65 ($\pm$ 1.96)	61.40 %	60.32 %
DK	3602	57.19 ($\pm$ 15.59)	67.04 ($\pm$ 14.23)	10.25 ($\pm$ 2.10)	63.58 %	42.94 %
FR	2003	46.50 ($\pm$ 15.57)	65.88 ($\pm$ 15.51)	9.43 ($\pm$ 2.11)	64.00 %	27.66 %
HU	1195	52.91 ($\pm$ 17.10)	65.14 ($\pm$ 12.61)	10.43 ($\pm$ 2.05)	52.60 %	26.78 %
IE	4487	49.26 ($\pm$ 15.61)	73.36 ($\pm$ 15.79)	10.90 ($\pm$ 2.06)	81.17 %	51.37 %
IL	1315	44.12 ($\pm$ 15.83)	64.46 ($\pm$ 16.62)	9.75 ($\pm$ 2.25)	69.31 %	37.30 %
IT	3500	51.58 ($\pm$ 18.00)	60.30 ($\pm$ 16.23)	9.20 ($\pm$ 1.96)	47.10 %	41.57 %
NO	2855	45.13 ($\pm$ 17.50)	69.06 ($\pm$ 14.35)	11.62 ($\pm$ 1.79)	79.40 %	33.75 %
PT	1247	46.14 ($\pm$ 16.69)	63.79 ($\pm$ 11.45)	10.27 ($\pm$ 1.42)	62.47 %	29.16 %
RU	5660	48.02 ($\pm$ 17.91)	62.17 ($\pm$ 13.75)	9.59 ($\pm$ 1.84)	39.82 %	62.33 %
SI	3360	51.64 ($\pm$ 17.69)	70.69 ($\pm$ 14.76)	10.64 ($\pm$ 1.91)	66.70 %	36.68 %
SK	2145	47.60 ($\pm$ 17.95)	60.79 ($\pm$ 15.54)	10.38 ($\pm$ 1.84)	55.61 %	47.06 %

AT = Austria, BE = Belgium, BG=Bulgaria, CH = Switzerland, CZ = Czech Republic, DE = Germany, DK = Denmark, FR = France, HU = Hungary, IE = Ireland, IL = Israel, IT=Italy, NO = Norway, PT = Portugal, RU=Russia, SI=Serbia, SK = Slovakia.

GALI = Global Activity Limitations Indicator, SD = standard deviation.

Table 3

Mediation analysis for general health literacy or social support as mediators of the association between them and limiting health, proportion mediated, average causal mediated effect (ACME) and *p*-value, adjusted for gender, age, education, and financial deprivation.

Country	Social support as a mediator between HL and limiting health (GALI1)			HL as a mediator between social support and limiting health (GALI2)		
	Proportion mediated, average	ACME (control) Estimate	ACME <i>p</i> -value	Proportion mediated, average	ACME (control) Estimate	ACME <i>p</i> -value
AT	0.254	0.00059	<0.001	0.048	0.00134	0.084
BE	0.198	0.00033	0.002	0.075	0.00097	0.066
BG	0.310	0.00084	0.032	0.082	0.00226	0.446
CH	0.092	0.00041	<0.001	0.265	0.00578	<0.001
CZ	0.181	0.00030	0.194	0.170	0.00203	0.210
DE	0.089	0.00024	0.008	0.153	0.00230	<0.001
DK	0.187	0.00053	<0.001	0.193	0.00361	<0.001
FR	0.406	0.00042	<0.001	0.001	−0.00001	0.982
HU	0.091	0.00036	0.182	0.239	0.00398	0.010
IE	0.075	0.00016	0.220	0.232	0.00249	0.022
IL	0.027	0.00004	0.764	0.046	0.00047	0.652
IT	0.007	0.00002	0.832	0.579	0.00403	<0.001
NO	0.284	0.00044	<0.001	0.052	0.00128	0.166
PT	0.030	0.00023	0.118	0.160	0.00508	0.024
RU	−0.005	−0.00001	0.870	0.408	0.00281	<0.001
SI	0.171	0.00049	<0.001	0.128	0.00293	<0.001
SK	0.074	0.00024	0.040	0.231	0.00372	<0.001

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ACME = Average Causal Mediated Effect.

outcome. SS was a significant mediator between HL and limiting health in 9 countries (GALI1). The data from France and Israel show no association between HL and GALI, hence mediation cannot be suggested. In three countries the proportion mediated was above 0.2.

In the alternative model with HL as the mediator of the association between SS and limiting health (GALI2), the mediation was statistically significant ($p < 0.05$) in 10 of the 17 countries. In five countries the proportion mediated is above 0.2, and in two countries it is below 0.1.

When comparing between the proportion mediated in the model with SS as the mediator between HL and limiting health (GALI1), the proportion mediated is higher in five countries compared to the model with HL as the mediator (GALI2), considering only the countries with significant mediation. In nine countries the proportion mediated was higher in the model with HL as the mediator (GALI2) compared to the model with SS as the mediator (GALI1).

4. Discussion

The results of this study, testing the model of mediation in 17 European countries, can help us understand the generalizability of the models (Figs. 1 and 2), since the data available to date stem mainly from East Asian countries.^{17–19,22}

The objective of this study was to analyze the relations between social support, health literacy and health outcomes. Four mediation models were tested. SRH1 tested SS as a mediator between HL and SRH and was found to be a significant mediator in all countries. This model may be applicable in more countries and with a higher proportion mediated than the second mediation model in which HL was the mediator between SS and SRH (SRH2) and was significant in 15 of the 17 countries. This model (SRH2) was also significant, however it has a higher proportion mediated in only four countries.

The two mediation models, in which limiting health is the health

Table 4

Mediation analysis for general health literacy or social support as mediators of the association between them and self-reported health, proportion mediated, average causal mediated effect (ACME) and *p*-value, adjusted for gender, age, education, and financial deprivation.

Country	Social support as a mediator between general HL and SRH (SRH1)			General HL as a mediator between social support and SRH (SRH2)		
	Proportion mediated, average	ACME (control) Estimate	ACME <i>p</i> -value	Proportion mediated, average	ACME (control) Estimate	ACME <i>p</i> -value
AT	0.104	−0.00058	<0.001	0.105	−0.00411	<0.001
BE	0.197	−0.00083	<0.001	0.104	−0.00326	<0.001
BG	0.207	−0.00088	0.006	0.176	−0.00589	0.032
CH	0.227	−0.00093	<0.001	0.108	−0.00412	<0.001
CZ	0.337	−0.00075	<0.001	0.083	−0.00211	0.142
DE	0.089	−0.00043	<0.001	0.158	−0.00410	<0.001
DK	0.228	−0.00112	<0.001	0.161	−0.00531	<0.001
FR	0.178	−0.00083	<0.001	0.129	−0.00460	<0.001
HU	0.078	−0.00032	0.016	0.294	−0.00603	<0.001
IE	0.063	−0.00020	0.024	0.278	−0.00319	<0.001
IL	0.216	−0.00089	<0.001	0.086	−0.00334	<0.001
IT	0.184	−0.00058	<0.001	0.100	−0.00244	<0.001
NO	0.254	−0.00069	<0.001	0.066	−0.00261	0.008
PT	0.173	−0.00047	0.044	0.018	−0.00075	0.282
RU	0.101	−0.00029	<0.001	0.148	−0.00280	<0.001
SI	0.198	−0.00081	<0.001	0.115	−0.00379	<0.001
SK	0.229	−0.00054	<0.001	0.076	−0.00188	0.016

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ACME = Average Causal Mediated Effect.

outcome, were significant only in eight countries (GALI1) and ten countries (GALI2). Therefore, it seems that HL as a mediator between SS and limiting health (GALI2) may be applicable in more countries and with higher proportion mediated compared to the mediation model with SS as the mediator between HL and limiting health (GALI1). This is the opposite when compared to SRH as the health outcome.

Thus, there is not one specific model of mediation that can be generalized across countries. Both HL and SS may serve as significant mediators in the models of both health measures, but to different extents. SS may serve as a more substantial mediator for the association between HL and SRH compared to limiting health (GALI). However, HL may serve as a more substantial mediator for limiting health compared to SRH. It is not possible to generalize from one country to another or from one model to another. Each must be tested individually.

These models suggest that HL and SS may impact health not only directly, but also through the other social determinants, SS through HL and HL through SS. Social support or social interactions can contribute to all aspects of HL, including interactive health literacy.³⁸ Friends, family, or acquaintances from different realms of life can be a resource to help access, understand, appraise, and use health information. In addition, they can help navigate health services in an effective way by advising on when, how, and where to turn for help, what opportunities are available and how to find out about them. The social network can also support the adoption of a healthy lifestyle or other health behaviors. It may also be suggested that individuals with certain levels of HL, particularly interactive HL, predispose people to seek and utilize social support which then enhances health.

In addition, this study suggests that the two measures of health used represent different aspects of health and well-being, as the results differ depending on the type of health measure used.

The complexity of how people evaluate their subjective health may depend also on culture,^{39,40} as is HL.⁷ Thus, both socioeconomic factors and social factors seem to affect the way individuals evaluate their health.^{41,42}

Consequently, a relevant question for this study emerges: does SRH measure the same condition in different ethnic groups? SRH does not necessarily have the same meaning in relation to objective measures of health as has been shown in Arabs and Jews.⁴² Therefore, we cannot presume that the question regarding the individual self-reported health has an identical meaning for the various population groups in the 17 countries studied. The fact that in all of the 17 countries tested in this

study, SS was a significant mediator between HL and SRH is quite impressive and suggests this may be a generalizable outcome.

In the model of HL as the mediator between SS and SRH (model SRH2) the model is significant in the majority of countries suggesting a generalizable model of mediation. It is possible that both models occur simultaneously.

The second measure of health (GALI) studied in this analysis differs from and complements SRH as it asks the individual to evaluate to what degree their health limits their activities in the last six months.³⁴ The biopsychosocial models introduce the person-environment perspective of the disability process, including the interaction of the individual with his/her environment in the evaluation of the level of limitation or disability. In Van Oyen et al.'s systematic review they compare the predictive validity of both of these health outcomes³⁴ and found that they were complementary predictors of mortality, indicating that they share some traits but add different dimensions.

To summarize, HL may affect health via social support more for SRH than for limiting health. In other words, SS may contribute less to improving limited health compared to its contribution to SRH as a mediator between HL and health outcomes.

The main limitation of this study is that each country collected the data differently, due to funding and logistic constraints. Most countries collected data during the COVID-19 pandemic, which influenced the methods chosen. Due to this constraint the comparisons between the countries can only compare the mediation models and percent mediated. In addition, countries are not one homogeneous community but include diverse communities that may differ from each other, which can only be considered on the national level, as this study combined communities within a country. Future studies should strive for more homogeneous and consistent data collection methods. Yet, the findings consistently point in the same direction, suggesting that the differences were not critical.

Another limitation is that the study is a cross-sectional survey, therefore, this study does not provide information regarding directionality or causality of the associations.

The strength of the study is that it is based on well-established and validated measures as well as a large number of participants and countries, possibly enabling generalization of the results to additional countries.

Future research should include a longitudinal study including interventions for improving HL or SS to observe if changes in HL and/or SS

can improve health.

Author statements

Ethical approval

The study was conducted in accordance with the Declaration of Helsinki. In each country, it has been ensured that ethical requirements have been met. For more information about ethical considerations, data protection, and informed consent by country, please see International Report on the methodology, results and recommendations of the European Health Literacy Population Survey 2019–2021 (HLS19) of M-POHL (HLS19 Consortium of the WHO Action Network M-POHL, 2021).

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Competing interests

The authors have no competing interests to declare.

Declaration of generative AI

We declare no use of generative AI.

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