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PUBLIC HEALTH & PRIMARY CARE | RESEARCH ARTICLE

Examining the factorial structure and validity of the everyday health information literacy screening tool

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Abstract: The term “health information literacy” denotes the set of abilities that enables individuals to search, retrieve, evaluate, and use health information to make adequate health decisions. Health information literacy is usually assessed by means of self-report questionnaires. The present paper examines the factorial structure and validity of a German version of the Everyday Health Information Literacy Screening tool (EHILS) in a sample of $N = 100$ university students. Internal consistency of the EHILS was low (Cronbach’s $\alpha = .54$), corroborating that health information literacy is a heterogeneous construct. Exploratory as well as confirmatory factor analysis revealed that the EHILS represents two facets of health information literacy, namely confidence (or self-perceived ability) and motivation of individuals to deal with health information. Regarding validity, differential correlations of the overall EHILS scores as well as the subindices motivation and confidence with health literacy measures, domain-specific self-efficacy beliefs, generalized internal control beliefs, and health information searching experiences were found. It is concluded that ability and motivation components of everyday health information literacy should be assessed separately to understand individuals’ health information behavior.

Subjects: Psychological Science; Population Health; Community Health; Health Communication

ABOUT THE AUTHOR

Dr. Anne-Kathrin Mayer graduated in Psychology at the University of Trier, Germany. Until October 2018 she was head of the Department “Research Literacy and User-friendly Research Infrastructures” at the ZPID-Leibniz Institute for Psychology Information. The research of her group is concerned with information literacy and information behavior in different domains, for example, academic information searching and everyday health information behavior and its personal and situational determinants. Knowledge gained from this research is used to improve information infrastructures (e.g., database surfaces), and/or to develop and evaluate interventions which aim at improving individual (health) information literacy.

PUBLIC INTEREST STATEMENT

In everyday life, most people at least occasionally have to deal with information related to health and well-being. The article introduces a questionnaire which assesses individuals’ motivation to deal with health information as well as their (self-)confidence in successfully finding, evaluating, and using this information from multiple sources (e.g., books, magazines, or the WWW). The questionnaire might be used by health professionals: Identifying individuals with low motivation and/or confidence to deal with health information will enable them to tailor health information better to their patients’ needs. Some patients might take more advantage of interventions aiming at strengthening interest in health information. Others should better be supported in their skills related to dealing with health information or provided with health information which is less complex and more easy to understand.

| **Keywords:** health information literacy; screening tests; questionnaires; test validity

1. Introduction

The term “health information literacy” has been defined by the Medical Library Association in 2003 as “the set of abilities needed to recognize a health information need, identify likely information sources and use them to retrieve relevant information, assess the quality of the information and its applicability to a specific situation, and analyse, understand, and use the information to make good health decisions” (Shipman, Kurtz-Rossi, & Funk, 2009, p. 294). These abilities are deemed essential to the empowerment of individuals who strive to improve their health and well-being: Being able to find and use high-quality health information will allow individuals to participate actively in health-related decision-making and to communicate well-informed with health professionals. For the assessment of health information literacy, reliable, valid and economic assessment tools are needed. The Everyday Health Information Screening tool (EHILS; Niemelä, Ek, Eriksson-Backa, & Huotari, 2012), a short self-report questionnaire, has been developed and tested within several Finnish samples with regard to its factorial structure, group mean differences, and associations with sociodemographic characteristics (Enwald et al., 2016; Hirvonen, Ek, Niemelä, Korpelainen, & Huotari, 2015). The present paper adds to this research by examining the factorial structure of a German version of the EHILS and by providing empirical evidence for the validity of the tool. To this means, the EHILS was applied in a sample of German university students, and its structural properties and correlations with conceptually related self-report questionnaires as well as cognitive ability tests were examined.

2. Theoretical background

Health information literacy may be interpreted as a subset of those abilities which make up the broader concept of “health literacy” (Eriksson-Backa, Ek, Niemelä, & Huotari, 2012). Sørensen et al. (2012) derived an integrated definition of health literacy based on 17 definitions that were identified in a systematic literature review: “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” (Sørensen et al., 2012, p. 3). To assess health literacy, direct or objective tests of individuals’ abilities as well as self-report questionnaires have been used (Altin, Finke, Kautz-Freimuth, & Stock, 2014; Haun, Valerio, McCormack, Sørensen, & Paasche-Orlow, 2014; Mackert, Champlin, Holton, Munoz, & Damasio, 2014). Most of these measures are limited to the assessment of “functional” health literacy (Nutbeam, 2000), that is, those basic verbal and numerical skills which are needed to read and understand health information. For example, the widely applied Test of Functional Health Literacy (TOFHL; Parker, Baker, Williams, & Nurss, 1995) assesses patients’ ability to extract information from text passages and phrases containing numbers by using real materials from health care settings.

Previous studies have provided evidence for a link between limited health literacy as assessed by these measures, and health outcomes or use of health services (Berkman, Sheridan, Donahue, Halpern, & Crotty, 2011). Moreover, the corresponding causal pathways have been theoretically elaborated (Paasche-Orlow & Wolf, 2007), and implications for health service practices have been derived (Batterham, Hawkins, Collins, Buchbinder, & Osborne, 2016). However, the measures have also been criticized for their lack of conceptual and empirical validity. Regarding their conceptualization, they draw on a quite narrow definition of “health literacy” as “functional literacy”, omitting its advanced facets (Nutbeam, 2000), namely “communicative/interactive literacy” (i.e. the ability to derive meaning from different forms of health communication), and “critical literacy” (i.e. the ability to critically evaluate and use health information). Thus, while they are well-suited to differentiate among persons with different levels of basic verbal and numerical abilities, they are not applicable in educated samples because of ceiling effects. Within these samples, interindividual differences may exist with regard to communicative and – most importantly – critical health

literacy, particularly the ability to seek, find, and evaluate evidence-based health information from high-quality information sources. To conceptualize these differences in more detail, drawing on the general concept of “information literacy” is helpful (e.g., Eriksson-Backa et al., 2012).

The American Library Association (1989) defined information literacy as a set of abilities needed to “recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information.” Stemming from library and information sciences, the construct has been primarily discussed in formal educational contexts (Lloyd, 2006). Although the importance of information literacy in informal learning contexts and everyday life has also been stressed (O’Sullivan, 2002), research on everyday information literacy is still in its beginnings (Yates et al., 2012). Lloyd and Williamson (2008) have emphasized that context plays a prominent role in understanding information literacy. One of the contexts in which information literacy of utmost relevance is health (Yates et al., 2012).

Most existing studies on health information literacy have been conducted in samples of medical or health science students (e.g., Haines & Horrocks, 2006; Ivanitskaya, O’Boyle, & Casey, 2006), or health and information professionals (Cullen, 2005). Others have examined the role of librarians in supporting the acquisition of health information (Burnham & Peterson, 2005). Adding to this research, Niemelä et al. (2012) have examined everyday health information literacy which they defined as competencies of literate persons “to find, evaluate, and understand health-related information in everyday life situations” (p. 2). To assess the construct, the authors developed a short self-report questionnaire. The Everyday Health Information Literacy Screening tool (EHILS) comprises 10 items referring to persons’ self-perceived ability and motivation to search, evaluate, understand, and use health information from different sources, that is, conventional media like books, magazines, newspapers, or TV as well as digital media and the internet. The EHILS has been applied in several Finnish samples of secondary school students (Niemelä et al., 2012), young men from the Finnish Defence Force call-ups (Enwald et al., 2016; Hirvonen et al., 2015), and individuals who are at risk for metabolic syndrome (Enwald et al., 2016). In addition, a Namibian version of the tool has been tested in university students (Huotari et al., 2016).

Regarding the psychometric properties of the EHILS, Niemelä et al. (2012) reported a reliability estimate of $\alpha = .56$ (Cronbach’s α) in a sample of upper secondary school students. A similar value of $\alpha = .57$ was found by Enwald et al. (2016) in a sample of adults at high risk for metabolic syndrome while in a study with young men from the Finnish military call-ups (Enwald et al., 2016; Hirvonen et al., 2015), a considerably higher estimate of $\alpha = .70$ emerged. As Niemelä et al. (2012) argued, these low to moderate estimates of internal consistency might be due to the items referring to different aspects of health information literacy. Supporting this interpretation, differential findings on group differences have been reported when conducting mean level-comparisons on an item basis while group differences were masked when all EHILS items were aggregated into one score. For example, Huotari et al. (2016) found that Namibian students expressed higher motivation to seek health information while Finnish students were more confident in their abilities to find, understand, and evaluate health information. In contrast, the EHILS total scores did not differ between the samples.

Based on these findings, it seems necessary to further explore the dimensional structure of the EHILS and possibly identify and validate different facets of everyday health information literacy which are captured by the tool. In an exploratory factor analysis in a Finnish student sample, Niemelä et al. (2012) identified three factors which were interpreted as “motivation,” “confidence” and “evaluation,” and included 9 of the 10 items. This three-factorial structure was corroborated in samples of Finnish young men as well as adults high at risk for metabolic syndrome (Enwald et al., 2016). In a Namibian student sample, however, the items related to confidence made up two separate factors, leading to a four-factor structure (Enwald et al., 2016).

Still, confirmatory tests of the multifactorial model have not been performed. In addition, none of the previous studies has related the EHILS to measures of health literacy, personality, cognitive

ability or information behavior to better understand what the tool precisely assesses. The present paper aims at filling these gaps by examining the factorial structure, and construct validity of a German version of the EHILS (Niemelä et al., 2012). To this means, the EHILS is applied together with other standardized tests and self-report measures in a sample of German university students.

3. Hypotheses, and research questions

To identify the structural properties of the EHILS, exploratory as well as confirmatory factor analyses are performed. Regarding validity, five hypotheses (H) and two additional research questions (RQ) are tested. As detailed above, the concept of health information literacy is closely related to that of health literacy. A model of health literacy which was elaborated within the HLS-EU project (Sørensen et al., 2012) distinguishes four aspects of health literacy (access/obtain, understand, process/appraise, and apply/use information relevant to health). As all of these aspects are related to dealing with health information, we hypothesized that the EHILS is positively associated with health literacy (H1).

Many of the EHILS items refer to self-perceptions of individuals' abilities to deal with health information. Thus, self-assessments of everyday health information literacy are conceptually closely related to the construct of "self-concept of ability" (e.g., Krampen, 1991). The self-concept of ability is one aspect of a person's multidimensional self-concept (Shavelson & Bolus, 1982) which refers to a person's generalized perceptions of his or her abilities. Individuals with a high self-concept of ability expect themselves to act in a competent way even *in situations* which present novel and unclear challenges to them (Krampen, 1991). In addition, the related construct "locus of control" (Rotter, 1966) was elaborated in social learning theory. Control beliefs are defined as generalized expectations about the correspondence between individuals' acts and their outcomes which are relatively stable over time and situations. People with high internal control beliefs assume that they have considerable impact on things happening to them as they are able to control these things by their own behaviors. On the other hand, people with high external control beliefs expect outcomes to be determined by other persons (powerful others control) or by chance or some higher power (fatalistic control). Based on these considerations, we assumed that everyday health information literacy is positively associated with generalized self-concept of ability and internal control beliefs (H2a) as well as negatively associated with external control beliefs related to "fatalistic control" and "powerful others control" (H2b).

According to self-efficacy theory (Bandura, 1982), acting successfully in a specific domain will foster domain-specific self-efficacy beliefs, which, in turn, will increase the probability of engaging actively in this domain. Thus, individuals with positive self-perceptions of their abilities will engage in health information searching behaviors more readily if they deem health information necessary. In accordance with this assumption, Hirvonen, Korpelainen, Pyky, and Huotari (2015) reported a negative correlation of the EHILS with information avoidance. Thus, we expect everyday health information literacy to be positively associated with the individual amount of health information searching experience (H3).

The EHILS includes several items referring to the motivation to obtain health-related information. Thus, it should be related to individual interest in health topics. The construct of interest denotes a content-specific motivational characteristic with positive feeling-related and value-related valences which guide behavior (e.g., Schiefele, 1991). Individuals with high interest in health topics will enjoy engaging in health information searching and will ascribe positive value to these activities. Thus, it was assumed that EHILS scores will show a positive correlation with individual interest in health topics (H4).

In addition, associations of the EHILS with participants' cognitive abilities are examined. If health information literacy was measured by an objective literacy test (i.e., an achievement test), a moderate positive correlation with verbal and nonverbal intelligence (which may be interpreted as relevant abilities underlying health information literacy) would be expected. However, as even self-reports and

objective measures of the same construct are often uncorrelated (e.g., Kruger & Dunning, 1999), no prediction was made, and a research question was specified instead: Are EHILS scores associated with measures of nonverbal and/or verbal intelligence? (RQ1)

Finally, we tested whether the EHILS scores are related to age and gender of participants. Regarding age, previous findings are inconclusive. Hirvonen et al. (2015) compared young Finnish men from three age groups (17 years, 18 years, 19 years, and above) and found the highest EHILS scores in the oldest age group. However, as only men from a very restricted age range were included in the study, the results may not be generalized. From a study including persons high at risk for metabolic disorder, Enwald et al. (2016) reported that older men (35–61 years) had lower scores than younger men (20–34 years) on EHILS items related to understanding and evaluating health information. Thus, again a research question was formulated: Are EHILS scores associated with age of participants? (RQ2) With reference to gender, results are more consistent. Niemelä et al. (2012) as well as Enwald et al. (2016) reported that women were more motivated to obtain health information than men. The present study sought to replicate this finding with the German EHILS in a student sample; thus, we assumed that women will score higher on the EHILS items related to motivation than men (H5).

4. Methods

4.1. Participants

$N = 100$ students (law: $n = 46$; business/economics: $n = 54$) from a German University participated in the study. Participants were between 18 and 35 years old ($M = 23.14$, $SD = 3.24$); 64% were female. 18% were in their first study year, 20% in their second year, 27% in their third year, and 35% in their fourth year and above. Only $n = 5$ participants reported that they had ever been involved in professional or voluntary work in the medical sector (e.g., as a nurse, paramedic, or nutritionist).

4.2. Measures

The test battery comprised, among a short sociodemographic questionnaire and several questionnaires which are irrelevant to this paper, the following standardized tests and questionnaires (described in their order of presentation):

- (1) Ravens Advanced Progressive Matrices (APM; Raven, Raven, & Court, 1998): Raven's APM were used as a measure of nonverbal fluid intelligence. Each of the 36 test items consists of a visual pattern with a missing piece. Subjects are requested to complete this pattern by choosing the correct solution from a set of eight alternatives. A time limit of 20 min was imposed on the test (Hamel & Schmittmann, 2006).
- (2) Verbal Analogy Tasks: To assess verbal intelligence, the 20-item subtest "Verbal Analogies" was taken from a German multidimensional intelligence test (Liepmann, Beauducel, Brocke, & Amthauer, 2007). Each forced-choice item consists of three words. Participants are required to identify the relationship between the first two words and to choose among five options the word that has a similar relationship to the third word given (e.g., "forest: trees" = "meadow: ?; options are: a) grass b) hay c) food d) green e) herbage", "a) grass" being the correct solution).
- (3) Everyday Health Information Literacy Screening tool (EHILS): The EHILS items were translated from their English version (as published in Niemelä et al., 2012) into German independently by the author of the paper and another researcher. Discrepancies between the translations were marginal and were resolved by discussion.¹ Each item was to be rated on a 5-point Likert scale from 1 (*totally disagree*) to 5 (*totally agree*), and the arithmetic mean of all items was computed as total EHILS score.
- (4) Experiences with topic-specific health information searches: A list of 11 health-related topics (e.g., "mental health problems," "conventional medical treatment [e.g., drugs, surgery]") was presented. Participants were asked to declare for each topic whether they had ever

conducted a systematic information search on it (*yes/no*). The 11 items were aggregated by summing up the number of “yes” answers. This sum score was used as a continuous index for the extent of “Search Experiences,” ranging from 0 to 11.

- (5) Interest in health information: Interest in health information was assessed by six items referring to participants’ interest in health topics, their intention to increase their knowledge about these topics, and their preoccupation with health information in general. Each item was rated on a 5-point Likert scale from 1 (*very low*) to 5 (*very high*), and the arithmetic mean of all items was computed.
- (6) European Health Literacy Survey (HLS-EU-Q47; Sørensen et al., 2013): The self-report questionnaire is based on a comprehensive model of health literacy detailed above. Each of the 12 facets of the model is covered by three to five items, resulting in 47 items describing specific health-related behaviors. All items are rated with reference to their difficulty on a 4-point Likert scale from 4 (*very difficult*) to 1 (*very easy*). From the answers, an overall health literacy index comprising all 47 items as well as subindices representing the four aspects of health literacy (“access/obtain,” “understand,” “process/appraise,” and “apply/use health information”) are computed.
- (7) Inventory for the Measurement of Self-Efficacy and Externality (I-SEE, Krampen, 1991): To assess participants’ self-concept of ability and generalized control beliefs, the I-SEE questionnaire was used. The 32-item questionnaire comprises four subscales with eight items each (self-concept of ability, internal control, fatalistic control, powerful others control). Second-order subscales are formed by aggregating “Self-concept of ability” and “Internal control” (Scale “Internality”), and “Fatalistic control” and “Powerful others control” (Scale “Externality”), respectively. Finally, after reversing the items referring to externality, all items are aggregated to a bipolar third-order scale (“Internality vs. Externality”). Each item is rated on a 6-point Likert scale.

4.3. Procedure

The study was run in January and February 2016. Voluntary participants were recruited via e-mail as well as pin board notices. They were debriefed about the aims of the study and the contents of the test battery in advance, and were financially compensated for their participation. Data collection took place in the university’s computer labs in group sessions with 4 to 20 participants who were supervised by student assistants. Most tests and questionnaires were applied in an online format using survey software (EFS Survey/Unipark), with the exception of Ravens’ APM which were presented in a paper-and-pencil format. The sessions took between 100 and 120 min.

5. Results

Means and standard deviations of the EHILS items are given in Table 1. Before estimating the reliability, items 04, 05, 08 and 10 were reversed. The internal consistency (Cronbach’s α) of the scale including all items (EHILS10) is $\alpha = .54$. Item-total correlations (see Table 1) varied between $-.04$ and $.43$, that is, in the very low to moderate range. The estimate of Cronbach’s α is comparable to the value of $.56$ reported by Niemelä et al. (2012), although considerably lower than in a study including a more heterogeneous sample (Hirvonen, Ek et al., 2015, $\alpha = .70$). It points to lack of unidimensionality of the EHILS and gives reason to further explore its structure by means of factor analysis.

Thus, a principal component analysis with varimax rotation was performed. The adequate number of factors was determined based on a parallel analysis (Horn, 1965) which was conducted using a SPSS syntax by O’Connor (2000). Two factors were extracted which explain a total of 36.4% of variance. The first factor is identical to the factor “motivation” found by Niemelä et al. (2012) with four items (03, 09, 01, 02) loading substantially ($a \geq .40$). The second factor considerably overlaps with the “confidence” factor identified in the Finnish studies, comprising two items (10, 04) from this factor as well as one item (07) from the “evaluation” factor which is not replicated in the present sample, and item 08 which had not been included in the analysis of Niemelä et al. (2012).

Table 1. Descriptive statistics and factor loadings of the EHIL10-items in a principal component analysis with varimax rotation

Item	M	SD	<i>r_{it-i}</i>	α (motivation)	α (confidence)
01. It is important to be informed about health issues.	4.26	0.68	.24	.53	
02. I know where to seek health information.	3.78	0.95	.43	.50	-.49
03. I like to get health information from a variety of sources.	3.69	0.90	.24	.75	
04. It is difficult to find health information from printed sources (magazines and books).	2.94	1.07	.15		.40
05. It is difficult to find health information from the Internet.	1.76	0.87	-.04		
06. It is easy to assess the reliability of health information in printed sources (magazines and books).	3.01	0.98	.08		
07. It is easy to assess the reliability of health information on the Internet.	2.09	0.90	.24		-.61
08. Terms and sentences of health information are often difficult to understand.	3.02	0.95	.34		.63
09. I apply health related information to my own life and/or that of people close to me.	3.43	1.02	.34	.72	
10. It is difficult to know who to believe in health issues.	3.50	1.12	.33		.73

M = arithmetic mean; SD = standard deviation; *r_{it-i}* = part-whole corrected item-total correlation with reference to EHIL10; α rotated factor loading (only loadings $\geq .40$ are printed; for explanations see text).

Based on these findings, two EHILS subindices with four items each are construed. The subindex “Motivation” is comprised of items 01, 02, 03, and 09. The internal consistency of this subindex is $\alpha = .60$. The second subindex, “Confidence” includes items 07, 08, 10, and 04. Cronbach’s alpha is $\alpha = .50$. Item 02 which loaded equally high on both factors is included into the subindex “Motivation” for reasons of comparability between the German and Finnish versions of the tool. Items 05 and 06 which do not load substantially on both factors are not integrated into the subindices.

To provide a preliminary confirmatory test of the two-factorial structure of the EHILS tool, confirmatory factor analyses (CFA) were conducted using MPlus Version 7.4 (Muthén & Muthén, 2015). The interpretability of the analyses is compromised by the small sample size: Usually, samples of $n > 200$ are recommended for a confirmatory test of a factor model; at least, the ratio between number of participants and number of free parameters in the model should be 5:1 or

Table 2. Fit statistics of the one-factor- and two-factor model in confirmatory factor analysis

Model	$\chi^2(df, p)$	RMSEA (90% CI, $p < .05$)	CFI	TLI	AIC
1 factor	31.106 (df 20, $p = .054$)	.075 (.000-.123, .203)	.815	.741	2150.558
2 factors	23.437 (df 20, $p = .268$)	.041 (.000-.099, .542)	.943	.920	2142.920

RMSEA = root mean square error of approximation, CI = confidence interval; CFI = confirmatory fit index. TLI = Tucker-Lewis-Index, AIC = Aikake Information Criterion.

higher (Bentler & Chou, 1987). To reach this ratio, only the eight EHILS items forming the subindices are included in the analyses, and items 05 and 06 were dropped.

In the analyses, a one-factor model (assuming a unidimensional EHIL measure) is compared to the two-factor model with two uncorrelated factors (“Motivation” and “Confidence”) which was derived from exploratory factor analysis. Table 2 provides an overview of the fit indices.

The fit indices demonstrate that the one-factor model does not fit the data. Only RMSEA would be just acceptable ($RMSEA < .08$) while the χ^2 -test as well as CFI and TLI give reason to reject the model. On the contrary, the two-factor model demonstrates acceptable fit which is better than that of the one-factor model according to the AIC value. Thus, the results justify upholding the assumption of a two-dimensional structure of the EHIL.

To examine the validity of the EHILS tool, correlations of the total score as well as the two subindices with other measures were computed. Table 3 shows the descriptive data (means, standard deviations) of the measures and their Pearson correlation coefficients with the EHILS scores. In accordance with Hypothesis 1, a positive correlation of $r = .47$ is found between the EHILS10 and the HLS-EU-47 total score. Correlations with the process-specific HLS-EU-47 index values are significant and positive as well. Regarding the two subindices, correlations of the EHILS subindex Confidence with the HLS-EU-47 are higher than those of the subindex Motivation which is due to the fact that both HLS-EU-47 and the EHILS subindex Confidence focus self-efficacy beliefs, i.e. participants’ cognitions about their abilities to deal with health-related information. On the contrary, the subindex Motivation assesses the importance participants ascribe to health topics and the personal relevance of having health information at their disposal.

With regard to Hypothesis 2, small but significant positive correlations of the EHILS total score are found with generalized self-concept of abilities ($r = .20$) and internal locus of control ($r = .23$) as well as negative correlations with both external locus of control scales (powerful others control: $r = -.22$; fatalistic control: $r = -.30$). The overall I-SEE measure of internal vs. external generalized control beliefs is moderately correlated with the EHILS total score ($r = .32$) and the Confidence subindex ($r = .31$), providing evidence that everyday health information literacy goes along with internality.

The index of health information search experience is only marginally correlated with the EHILS total score. However, a significant positive correlation of $r = .30$ with the subindex Motivation is found. Thus, participants with more comprehensive experiences with health information searches achieve higher EHILS scores as proposed in Hypothesis 3 which is not due to higher confidence in the ability to find information but to higher interest and/or relevance of the topic to persons with more search experience. This interpretation is corroborated by the results referring to Hypothesis 4: There is a high positive correlation of individual interest in health topics with the EHILS subindex Motivation ($r = .54$) but not with the subindex Confidence ($r = -.04$).

Regarding Research Question 1 and 2, both EHILS total score as well as subindices are uncorrelated with general cognitive abilities as well as age of participants. Finally, on the subindex

Table 3. Means and standard deviations of the measures and correlations with the EHIL10 and EHIL-subindices

Instrument	Scale/Test	M	SD	α	r(EHIL10)	r(EHIL-Motivation)	r(EHIL-Confidence)
HLS-EU-Q47	Total mean	2.75	0.32	.91	.45**	.21*	.42**
	Access/obtain health information	2.77	0.40	.80	.45**	.27**	.39**
	Understand health information	3.04	0.36	.72	.29**	.13	.33**
	Process/appraise health information	2.41	0.42	.81	.40**	.19*	.42**
	Apply health information	2.80	0.38	.68	.25**	.08	.23**
	Self-concept of ability	3.88	0.68	.74	.20*	.10	.19*
	Internality	4.03	0.55	.67	.23**	.19*	.06
	Externality—powerful others	3.17	0.60	.66	-.22**	.00	-.31**
	Externality—fatalistic	3.05	0.72	.76	-.30**	-.07	-.33**
	Self-concept of ability +internality	3.96	0.54	.80	.24**	.16	.15
Search Experiences	Externality—powerful others +fatalistic	3.11	0.58	.81	-.30**	-.04	-.37**
	Internality vs. Externality	0.85	0.96	.86	.32**	.11	.31**
		6.41	2.24	.63	.16	.35**	-.01
Interest		3.33	0.74	.85	.29**	.54**	-.04
		19.37	4.17	.81	.01	-.16	.16
Cognitive abilities		11.59	2.95	.69	-.03	-.18*	.09
		23.14	3.24		.02	-.05	.13

M = arithmetic mean; SD = standard deviation, α = Cronbach's Alpha, r = Pearson correlation

* $p < .05$; ** $p < .01$

Motivation, men ($M = 3.55$, $SD = 0.68$) score significantly lower than women ($M = 3.93$; $SD = 0.57$; $t(98) = -2.99$; $p < .01$, one-tailed), as was proposed in Hypothesis 5. On the subindex Confidence, men ($M = 2.68$, $SD = 0.81$) score numerically higher than women ($M = 2.44$, $SD = 0.61$) but the difference fails to reach statistical significance, $t(98) = 1.64$, $p = .11$, two-tailed). No significant gender difference is found on EHILS10 total score ($t < 1$).

6. Discussion

The aim of the present study was to examine the factor structure and validity of a German version of the EHILS tool (Niemelä et al., 2012), a short self-report measure designed to assess individuals' level of everyday health information literacy. To this means, the tool was applied together with several questionnaires and achievement tests in a student sample. As Niemelä et al. (2012) argued, health information literacy is a heterogeneous construct. This is reflected in the moderate reliability of the EHILS total score as well as the factorial structure of the questionnaire: Results of exploratory as well as confirmatory factor analyses speak against the unidimensionality of the tool. Instead, they point to a two-factorial structure and suggest the construction of subindices reflecting two independent components of health information literacy which have also been identified with the original version of the EHILS (Niemilä et al., 2012). The first subindex, termed "Motivation," relates to interest in health information and perceived relevance of health information for participants' lives. Supporting this interpretation, the subindex is correlated with measures of interest in health information as well as the self-reported amount of search experiences with various health-related topics.

The second subindex, "Confidence," reflects the self-perceived ability to find, evaluate and interpret health information from various sources. It combines items from the "Confidence" and "Evaluation" factors identified in the Finnish sample by Niemelä et al. (2012) as well as one item that was not included in Niemelä's analysis and indirectly refers to the ability to understand health information. Thus, the subindex may be interpreted as an index assessing domain-specific self-efficacy beliefs related to health information behavior. Further studies examining its correlations with information literacy self-efficacy scales (Behm, 2015; Kurbanoglu, Akkoyunlu, & Umay, 2006) might confirm this interpretation.

"Motivation" and "(Self-)Confidence" to deal with health information represent one construct, that is, everyday health information literacy. However, the two facets of health information literacy proved to be empirically independent of each other. Thus, while in some persons the motivation and confidence to deal with health information are congruent (either both high or both low), other persons may experience a discrepancy between both facets, i.e. the motivation to search for health information may be high while self-efficacy beliefs related to finding, understanding, and evaluating this information are low, and vice versa. To explain which this is the case, one might speculate that situational factors differentially affect both facets. For example, the motivation to deal with health information might be strongly influenced by changes in health status which increase the personal relevance of health information. Confidence, on the other hand, might be fostered by providing health information which is easily accessible and understandable, thus allowing the experience of dealing competently with this information to make health-related decisions. Furthermore, the relations of both facets with performance-based measures of health (information) literacy, that is, the "objective" knowledge and skills related to dealing with health information, should be clarified. As Nutbeam (e.g., Nutbeam, 2015) argued, knowledge, motivation, as well as self-confidence may be considered patient capabilities which are essential for improving adherence to recommended clinical care as well as, finally, improved health outcomes. Previous research (Mayer, 2018) has provided evidence for weak but significant associations of knowledge related to health information searching with questionnaire measures of subjective health (information) literacy which primarily aim at assessing the confidence facet of the concept. Relations with the motivation facet still have to be identified.

Several important limitations have to be considered when interpreting the results. First, sample composition might be biased by self-selection of participants with high interest in health issues. However, as participants received a monetary compensation which was higher than usual for German university students, we assume that pronounced interest in the topic of the study was not the major motivation to participate. Second, the fact that a homogenous sample of young, well-educated adults was recruited, has considerable impact on reliability as well as validity. Cronbach's Alpha which was used as an estimate of internal consistency is too low to recommend using the total score or the subindices for the diagnosis of individuals' everyday health information literacy. Therefore, researchers might think about adding items referring to the "Motivation" and "Confidence" of individuals to deal with health information in order to improve the reliability of the subindices. However, values of Cronbach's Alpha are sufficiently high to apply the tool for research purposes and to conduct statistical analyses on a group level (e.g., comparisons of means, significance testing of correlations). In addition, statisticians have cautioned against abandoning a tool only because of its low internal consistency (e.g., Streiner, 2003). These tools may still be valuable for researchers if their concurrent and predictive validity is demonstrated (e.g., Schermelleh-Engel & Werner, 2008). Finally, Cronbach's Alpha is strongly influenced by sample composition, with more homogeneous samples (e.g., with regard to demographic characteristics like age and education) often implying reduced score variability (Onwuegbuzie & Daniel, 2002), and, thus, lower reliability. In the present study, a very homogenous sample of well-educated young adults was tested. This might have led to restricted population variance, and, therefore, low internal consistency.

Future research should strive to replicate the findings in larger samples which are more heterogeneous with regard to age, education, and other social background variables. To further validate the tool, the EHILS should be applied together with objective measures of health information literacy, i.e. knowledge and achievement tests, before applying it in research as well as applied health-related contexts, for example, prevention and health promotion or counseling of individuals suffering from acute or chronic illness. In these contexts, the EHILS might be used as a screening tool to identify individuals with a remarkably low motivation to attend to health information. In those individuals, interventions might aim at sensitizing them for the importance of health information and acquiring health-related knowledge when it comes to contributing actively to health-related decisions. Additionally, the EHILS allows to identify individuals with low confidence in their abilities to find and use health information. These persons possibly have little prior experience with health information search and evaluation, and, thus, have not acquired the knowledge and skills needed to deal with this information. In this case, offering health information literacy training might be an effective way of strengthening their competencies and, hereafter, their self-efficacy beliefs. However, self-efficacy beliefs might also be low because individuals feel overtaxed by available health information which is often complex, contradictory and/or difficult to understand. Following this line of reasoning, more effort should be invested to improve the comprehensibility as well as the accessibility of health information for this target group.

In sum, we argue that ability and motivation components of everyday health information literacy should be assessed separately to better understand individuals' health information behavior and support their autonomy regarding health-related decisions. In the corresponding research, the EHILS may be used as a preliminary measure of both components.

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Note

1. The German version of the EHILS is available from the author.

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