Know Thyself! The Role of Adequate vs. Inadequate Self-Assessment of Relevant Skills in the Preference for Health Information

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Abstract: An independent search and the adequate understanding of health information form an important basis for informed decision making in case of a health problem. The fundamental skills coming into effect in this situation are health information literacy (HIL) and general cognitive ability (IQ). The consequences of an adequate vs. less adequate assessment of one's own abilities for everyday decisions are considerable, but have not yet been investigated in the context of health information seeking. We examined if HIL and IQ have unique effects on the preference of certain properties of health information sources (expertise, interaction, accessibility). Furthermore, in an explorative analysis, we examined differences in the effects of self-assessment and performance measures of HIL and IQ. Here, we looked further into the effects of over- or underestimating one's own abilities with regard to the preference of certain source properties. N = 286 individuals took part in our study. Using response surface analyses, we found a differentiable influence of HIL and IQ on the preference of source properties. In addition, we identified specific effects of self-assessed and objectively measured skills and the interaction of these measures (over- or underestimation). In addition to actual ability, the self-assessed ability as well as the resulting under- or overestimation play an important role. Researchers and practitioners should take this into account when developing and implementing measures to promote informed decision making among patients.

Keywords: health literacy, cognitive ability, self-assessment, information seeking

In our health care system a healthy and long life requires the greatest possible autonomy on the part of the patients - they are responsible for initiating adequate health behavior on their own and, in some cases, making critical decisions (Ubel, Scherr & Fagerlin, 2017). Accordingly, appropriate health behavior requires active information about the possibilities and the individual fit of the alternatives. Autonomous action is supported by a comprehensive information offer, but is at the same time made more difficult by the large amount of possibilities of information procurement in the modern information society. A wide range of skills is needed to be able to make targeted use of the countless opportunities to obtain information (Berkman et al., 2011). In addition to technical skills, cognitive and linguistic skills are required above all to separate correct from incorrect information. Sources of information that are selected and used in the search

process from a variety of possible sources are a decisive factor in determining whether suitable information is obtained.

Accordingly, the term "Health Information Literacy" (HIL) can be used to sum up the skills needed to (1) find relevant information, (2) understand this information, (3) question it critically, and then (4) translate it into one's own health behavior (Baker, 2006; Sørensen et al., 2012).

As mentioned at the beginning, evermore critical decisions have to be made on the basis of personally procured information. Thus, HIL represents a central influencing factor with regard to mental and physical health (Berkman et al. 2011). Often, however, one's own abilities are misjudged (DeNisi & Shaw, 1977; Paulhus, Lysy & Yik, 1998) - which is problematic in the health context because over- and underestimating relevant abilities such as HIL can have a decisive influence on the individual health behavior (Dunning, Heath & Suls, 2004). An overestimation of the personal abilities can quickly lead to trusting populist sources that spread false information, or, in the case of an underestimation, prolonging or avoiding the process of decision making and translation into actual health behavior. For this reason, the present study examines differences between objective performance measures and subjective self-reports of HIL and their interaction with regard to the preference of basic characteristics of health-related information sources.

Health Information Literacy, cognitive skills and self-assessment

The concept of HIL can be understood as a combination of "Health Literacy" and "Information Literacy" (Eriksson-Backa, Ek, Niemelä & Huotari, 2012). According to Sørensen et al. (2012), health literacy is related to general reading and writing skills and refers to the knowledge, motivation and competences of an individual to acquire, understand, evaluate and apply health information in order to ultimately make health-related judgements and decisions in everyday life, covering health care, disease prevention and health promotion. This serves the goal of maintaining and improving the quality of life. The definition of Information Literacy by the American Library Association (1989), on the other hand, includes the skills required to recognize a need for information and to find, evaluate and effectively use the required information -thus, HIL can be considered a product of Health Literacy and Information Literacy.

In the past however, criticism of the autonomy and detachability of the construct HL (and thus of an essential component of HIL) arose (e.g. Fawns-Ritchie, Starr & Deary, 2018). Furthermore the inconsistent and very broad definition as well as the redundancy to general cognitive abilities were criticized (Reeve & Basalik, 2014). In fact, there seems to be a large overlap between H(I)L and cognitive abilities in the definitions. Thus, the literacy concepts mentioned above include many skills that are generally also measured in intelligence tests, such as analytical (Lenox & Walker, 1993) and problem-solving skills (Brand-Gruwel, Wopereis, & Vermetten, 2005), as well as a certain amount of cognitive flexibility (Stern & Neubauer, 2013). Correspondingly, studies by Reeve & Basalk (2014) suggest that there is no incremental gain of HL over cognitive skills in the criterion validity of health behavior and consequences. This may, however, be due to the measuring instruments used to assess HL, which only assess the rudimentary aspects of reading and writing skills in the health context and not the more differentiating aspects. Therefore the

specific (thus distinguishable from cognitive ability) benefit of a more differentiated assessment of HL with regard to predicting health-related behavior remains to be clarified. If it turns out that HL has a predictive value for health behavior separable from cognitive ability, specific intervention options can be derived from this, which can be implemented at the individual as well as at the socio-educational level. For this reason, the present study additionally examined whether there are distinguishable effects of HIL from cognitive abilities.

For many important decisions in everyday life not only the actual expression of an ability is crucial, but also its self-assessment (Ackerman & Wolman, 2007; Freund & Kasten, 2012). Self-assessment and actual abilities are often moderately correlated (Ackerman & Wolman, 2007; Zell & Krizan, 2014), but in individual cases they can differ greatly. This is particularly relevant in the health context: Those who underestimate their research skills may not even begin to search for health information. Those who overestimate their ability to evaluate health information may fall for misinformation. In psychology, comparisons between self-assessments and actual abilities play a central role, since these are not only relevant in terms of measurement theory, but also in terms of content (Freund & Kasten, 2012). One of the most significant findings in this area is a study conducted by Kruger and Dunning (1999), which showed that people tend to overestimate their own performance - and the lower their objective performance, the more so. In the upper performance ranges, however, this effect was reversed, so that an underestimation was more likely to be observed in the top quartile. These over- and underestimates can lead to maladaptive behavior, depending on context and performance measures (Ackermann & Wolman, 2007). The simultaneous observation of self-estimated and objectively measured performance makes it possible to analyze the interaction of the two variables more precisely, which can be particularly decisive in the case of self-responsible health behavior for the reasons mentioned above.

However, the simultaneous consideration of the two measures has not yet been done with regard to HIL, which is why this will be done in the following by means of an exploratory approach. Whether and to what extent possible misjudgments have an effect on health-related information behavior must be recorded at a suitable point in the research process. Once an existing need for health information has been identified, the selection of an adequate source is the first degree of freedom and thus potentially risky. The selection of a particular source determines how the obtained information is structured. This determines, for example, whether objective or opinion-forming information is available to the user, how easily these are understandable and which target group they address, whether prior information is required and whether they are simply "wrong" or "right". Since there are a multitude of potential sources for health-related topics, which cannot all be considered at the same time, the consideration must be made on a more abstract level. Wedderhoff, Chasiotis, Rosman and Mayer (2018) were able to show that all conceivable sources of health information can be classified on the three dimensions of accessibility (amount of effort required to use them profitably), expertise (degree of scientific substantiation) and interaction or relationality (extent of personal interaction between the source and the user). Therefore, the preference for these three characteristics of health information sources should be considered as a relevant effect of the two influencing variables *HIL* and *cognitive abilities*.

These remarks give rise to three exploratory research questions, which are examined in the present study.

1. Do HIL and cognitive abilities show a differentiable predictive contribution with respect to the preference of the source properties expertise, interaction and accessibility?

2. Do self-reports and performance tests show a differentiable predictive contribution regarding the preference of the source characteristics expertise, interaction and accessibility?

3. What influence does the interaction of self-evaluated and objectively measured performance measures (over- or underestimation) of HIL and cognitive abilities have on the preference of the source characteristics expertise, interaction and accessibility?

Methods[1]

N = 289 participants were recruited for the study. After exclusion of persons who had answered incompletely, the final sample consisted of N = 286 students of the University of Trier aged 18-46 years. The average age was 23.52 years (SD = 3.25). 80% (n = 228) of the participants were female. The processing of the questionnaires was computer-assisted in group surveys with a maximum of 20 participants in the computer rooms of the University of Trier.

A self-constructed item was used to record the self-assessed cognitive abilities. The Standard Progressive Matrices Test by Raven (1941) was used as a performance test of cognitive abilities. The self-assessment of HIL was assessed using a version of the Self-Efficacy Scale for Information Behavior (SES-IB) by Behm (2018) adapted to the health context. The Health Information Literacy Knowledge Test (HILK; Mayer, Holzhäuser, Chasiotis & Wedderhoff, 2018) was used as the performance test of the HIL. The query of the dependent variables of the preference for specific properties of information sources was carried out by agreement on a five-level Likert scale (1 = "do not agree at all" to 5 = "completely agree ") on four self-developed items each for the three property dimensions accessibility (e.g. "...I prefer to use information that is easy and quick to find"), expertise (e.g. "...I prefer information from people who have acquired knowledge relevant to my concern through their professional training") and interaction (e.g. "...I prefer to independently search for information on the situation") according to Wedderhoff et al. (2018).

To investigate the research questions, response surface analyses (RSA; Schönbrodt, 2016) were conducted using self-reports and performance tests as predictors for each source property as a criterion. RSA are particularly suitable for the investigation of discrepancies. In contrast to methods that rely on absolute or squared difference values, RSA are scale-independent and

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[1] A detailed documentation of the analyses and results including R-code and illustrations can be found in Open Data 1 (OD 1) the article in PsychArchives: http://dx.doi.org/10.23668/psycharchives.2683.

overcome other central problems of "classical" interaction analyses such as moderated regression (Schönbrodt, 2016).[2]

Results

A detailed list of the different model indices of the most suitable and the next best model (according to ΔAICc, model weight, R^2_{adj} and p_{model}), which were used for the respective selection, can be found in Table 1. The comparison of the results[3] between HIL and cognitive abilities in relation to the first research question showed that both constructs have distinct predictive effects on the preference of the level of expertise, the personal interaction possibilities and the accessibility of health information sources. A closer look revealed differences in the design of the predictive models. While in HIL the interaction of predictors only occurred with respect to the preference of relational sources and otherwise only linear effects of a single predictor were identified, no effect at all could be found with respect to cognitive abilities when predicting the preference of relationality. Furthermore, a quadratic effect was found in the preference for accessibility and an interaction of the predictors in the prediction of the preference for expertise. Thus, with respect to the first research question, it can be concluded that cognitive abilities, compared to HIL, provide potentially distinguishable predictive contributions to the preference of source properties.

To investigate the second research question, a more differentiated consideration of the individual results of the response surface analyses is required. Only one of the two predictors was relevant for the prediction of expertise and accessibility by HIL (see Table 1). It was shown that the lower the self-estimated HIL was, the more accessible sources were preferred (linear effect). Furthermore, a positive linear effect of objectively measured HIL on the preference of sources (see Table 1) was shown that demonstrate a high degree of expertise, i.e., the higher the expression in the HIL performance test, the more such sources were preferred. With regard to cognitive abilities, a quadratic effect was found (see Table 1): The lowest preference for accessible sources was found among persons with (relative to the sample) average objectively measured cognitive ability, while persons with low and persons with high cognitive ability preferred more accessible sources. To investigate the effects of over- or underestimating the personal HIL and cognitive abilities (question 3), the interaction models of the response surface analyses were considered (see Table 1, SRRR model of UV HIL and SQD model of UV cognitive abilities). It was found that *under*estimating the personal HIL leads to a preference for sources that allow interaction with other people. It was also shown that both over- and underestimation of the personal cognitive abilities lead to a preference for sources that have a low level of expertise (i.e. information that is more likely to be provided by laypersons). In turn, adequate ability assessment led to a preference for sources with a high degree of expertise.

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[2] A detailed description and justification of the method of analysis can be found in Open Data 2 (OD 2) of the article in PsychArchives: http://dx.doi.org/10.23668/psychArchives.2683.

[3] A detailed documentation of the analyses and results including R-code and illustrations can be found in Open Data 1 (OD 1) the article in PsychArchives: http://dx.doi.org/10.23668/psycharchives.2683.

Discussion

The current study explored three questions related to the importance of self-assessed and objectively measured relevant skills for the preference of health information. With regard to the first question, it was shown that HIL and cognitive abilities make a distinguishable predictive contribution to the preference of the level of expertise, the possibility of personal interaction and the accessibility of health information sources, regardless of the type of measurement. In the current discussion on the (non-)redundancy of (health) information literacy and cognitive skills (see e.g. Reeve & Basalik, 2014), the results indicate that a relevant incremental knowledge gain can be expected when both skills are considered simultaneously compared to either HIL or cognitive skills. Therefore, specific intervention programs to increase HIL have their reason to exist (see two reviews of HL interventions: Jacobs, Lou, Ownby, & Caballero, 2016; Sheridan, Halpern, Viera, Berkman, Donahue, & Crotty, 2011). The focus on context-specific skills can be applied to any form of individual cognitive ability. Nevertheless, different experiences in dealing with health information, the individual level of education and cognitive abilities must not be disregarded and corresponding interventions must be designed and applied in a context-sensitive manner. Intervention programs can thus reduce the existing social inequality in health literacy levels (see Schaeffer, Vogt, Berens, & Hurrelmann, 2016) and thus contribute to greater social justice in health care.

The second question was related to the respective contribution of subjective or objective HIL and cognitive ability in terms of preference for characteristics of health information. The finding that higher *objective* HIL leads to a preference of sources with a high level of expertise seems to be obvious in view of the competencies that HIL encompasses. The ability to understand and critically review information can lead to the view that health information provided by experts is most trustworthy (Avery, 2010) in the long run, which may lead to a preference for such sources (Hesse et al., 2005). Furthermore, it was shown that *subjective* HIL has a negative effect on the preference for accessibility of a source. This may be due to the fact that for people who do not dare to find appropriate information or to understand sophisticated information, the accessibility of the source is more important than for people who dare to do so (Bernat et al., 2016). For the latter, the criterion of accessibility takes a back seat, as they are more likely to find and understand suitable information of any kind. The quadratic effect that easily accessible sources are preferred in the case of objectively low as well as high cognitive abilities seems plausible only for a low level of cognitive abilities: Those who experience that they often do not understand information will consider the accessibility of a source to be important, similar to the case of subjectively low HIL. In the case of high cognitive abilities it may be the case that such persons have experienced that their preferred sources are also accessible, since they generally have less difficulty in dealing with and classifying different information (Ackerman, 1996).

With regard to the third question, and thus the importance of an adequate self-assessment of the personal abilities, the analyses showed that an underestimation of HIL goes hand in hand with a preference for sources that allow a high degree of personal interaction. This finding can be explained by the fact that, following the definition of Nutbeam (2000), an essential part of HIL are

advanced communicative and social skills that allow a person to extract meanings from different forms of communication. A lack of self-assessment with relatively higher actual abilities at the same time now leads to the fact that the personal abilities are more likely to be attributed to other persons, although the goal-oriented social interaction in the context of the search for health information is only made possible by HIL.

With regard to cognitive abilities, it was shown that both over- and underestimation lead to a preference for layman-mediated information, while an adequate assessment favors the preference of experts. This finding supports other findings (e.g. Ackerman & Wolman, 2007) that people with realistic self-images are more likely to be able to make decisions appropriate to their abilities than people with false self-images. For example, those who correctly assess themselves as less capable may be more willing to seek advice from experts. On the other hand, people who underestimate themselves in terms of their cognitive abilities may not dare to process expert information and may be forced to resort to lay information. Persons who overestimate themselves, on the other hand, might feel that they can already sufficiently assess the information situation if they rather take layman information into account, because they perceive it as equal to expert information and experience that they understand it more easily. Ehrlinger, Mitchum and Dweck (2016) found that people who overestimate their cognitive abilities tend to prefer information and tasks that are easy to understand. This tendency could in turn lead to an overestimation of their own cognitive abilities, since a confrontation with more complex information material does not even occur.

One of the main points of criticism of the present study is the purely explorative and thus not hypothesis-led examination of our questions. The results thus form a purely inductive basis for future confirmatory research on the significance of individual abilities and their self-assessment in dealing with health information. Furthermore, the interpretations made above are to be regarded as preliminary, since causal conclusions cannot be drawn with the available data. A further point of criticism concerns the exclusive consideration of preferences for certain source characteristics that were recorded with the help of a questionnaire. In future studies, suitable behavioral measures that can be predicted by the property preference should be included (e.g. search tasks). In addition, the student sample limits the generalizability of the findings - although this seems justifiable with regard to the inductively guided procedure, in future confirmatory studies patient and representative samples of the general population should be used.

Despite the limitations mentioned above, the study provides first indications of the relevance of (1) the simultaneous consideration of HIL and cognitive abilities in the investigation of health information behavior, and (2) an adequate self-assessment of these abilities in the search for health information. After further empirical validation of our exploratory findings, this should be taken into account in the development and implementation of measures to promote self-determined and informed decision making in the health context.

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