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DOI
10.1037/pas0000332

Publication date
2017

Document Version
Final published version

Published in
Psychological Assessment

Citation for published version (APA):
te Poel, F., Hartmann, T., Baumgartner, S. E., & Tanis, M. (2017). A Psychometric evaluation of the Dutch short health anxiety inventory in the general population. *Psychological Assessment*, *29*(2), 186-198. https://doi.org/10.1037/pas0000332

Psychological Assessment
2017, Vol. 29, No. 2, 186–198

1040-3590/17/$12.00 http://dx.doi.org/10.1037/pas0000332

A Psychometric Evaluation of the Dutch Short Health Anxiety Inventory in the General Population

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Distress or anxiety about health is known as health anxiety. One of the most widely used scales to measure health anxiety is the Short Health Anxiety Inventory (SHAI; Salkovskis, Rimes, Warwick, & Clark, 2002). The current study contributes to both the applicability and understanding of the SHAI by making 5 interrelated methodological contributions: (a) developing a Dutch translation of the SHAI, (b) validating this translation in the Dutch general population, (c) comprehensively examining its factor structure, (d) examining predictive validity and test–retest reliability of test scores, and (e) testing measurement invariance across subsamples and over time and comparing SHAI scores in subsamples of healthy and ill individuals and males and females. Data were collected from 5,310 respondents in 2 consecutive waves with a 2-month time gap. The results revealed that the SHAI comprises 2 factors: Illness Likelihood (14 Items) and Negative Consequences of Illness (4 Items). Further empirical evidence for the measurement invariance of this factor structure across subsamples and over time was revealed, as well as predictive validity, internal consistency and test–retest reliability of test scores, thereby proving that it is a useful tool for measuring health anxiety in the general Dutch population. On the basis of our results, we recommend that the 14-item SHAI, that is, the Illness Likelihood subscale, be adopted to measure health anxiety in future studies. We suggest slight adaptations to some answer options and argue that the benefit of adding the Negative Consequences of Illness subscale is debatable.

Keywords: health anxiety, Short Health Anxiety Inventory, psychometric properties, factor structure, validation, measurement invariance

Supplemental materials: http://dx.doi.org/10.1037/pas0000332.supp

Distress or anxiety about health is known as *health anxiety* (Abramowitz, Deacon, & Valentiner, 2007a; Asmundson, Abramowitz, Richter, & Whedon, 2010; Williams, 2004) that can be interpreted as a dimensional construct in which individuals differ in terms of severity (Asmundson et al., 2010). Hypochondriasis reflects excessive anxiety at one end of this continuum (Ferguson, 2009).[1] Health anxiety is characterized by the often unwarranted or excessive belief or fear that one has a serious illness or medical condition (Salkovskis, Rimes, Warwick, & Clark, 2002). Health anxiety is a frequently studied topic, particularly in Western societies, because scholars suggest that it may be fueled by widespread access to online health information (i.e., "cyberchondria"; Starcevic & Berle, 2013; Starcevic & Berle, 2015) and because health anxiety is positively related to health care utilization (Barsky, Ettner, Horsky, & Bates, 2001).

Several self-report measures are available to assess health anxiety in the general population, such as the Whitely Index (Pilowsky, 1967), the Illness Attitude Scale (Kellner, 1987), and the Illness Behavior Questionnaire (Pilowsky & Spence, 1975). One of the most widely used scales to measure health anxiety is the Short Health Anxiety Inventory (SHAI; Salkovskis et al., 2002), both in clinical and nonclinical settings (Alberts, Hadjistavropoulos, Jones, & Sharpe, 2013). Salkovskis et al. (2002) developed the SHAI as a self-report tool that can be applied to assess health anxiety in the general population independent of clinical diagnos-

This article was published Online First May 12, 2016.

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This article makes use of data from the Longitudinal Internet Studies for the Social Sciences (LISS) panel administered by CentERdata (Tilburg University, the Netherlands). The LISS panel data were collected by CentERdata through its MESS project funded by the Netherlands Organization for Scientific Research. More information about the LISS panel can be found at www.lissdata.nl. The authors thank Rinaldo Kühne for his valuable advice on aspects of the data analytical procedure.

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[1] The fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-5*) replaced hypochondriasis and related conditions with illness anxiety disorder and somatic symptom disorder (American Psychiatric Association, 2013).

tic interviews. In addition, they aimed to create a scale that assesses health anxiety independent of a person's actual health status. As Salkovskis et al. (2002) argued, "such a scale should not rely on items such as 'I believe that I am physically ill,' as patients who are ill but not suffering from elevated levels of anxiety would tend to score highly" (p. 844). Salkovskis et al. (2002) specifically developed the SHAI (18 items) to meet this requirement.

The current study seeks to further contribute to both the applicability and understanding of the SHAI. More specifically, the current study makes five interrelated methodological contributions. First, interpretation of scores on the original English SHAI (Salkovskis et al., 2002) was only validated in English-speaking countries (Alberts et al., 2013), and it has recently been validated in Spanish (Morales, Espada, Carballo, Piqueras, & Orgiles, 2015) and Chinese (Zhang, Liu, Li, Mao, & Yuan, 2015). The present study introduces a validated Dutch version of the SHAI that has been developed based on a translation-retranslation paradigm. Second, in most studies, the SHAI has only been administered to student samples, clinical samples (see for an overview in Alberts et al., 2013) or adolescents (Morales et al., 2015), whereas assessments of the SHAI in the general population have been rare. The present study presents an examination of the SHAI based on a large and representative sample of the general Dutch population. Third, in the present study, the factor structure of the SHAI is comprehensively examined to increase our understanding of dimensionality (Alberts et al., 2013). More specifically, we compare the different factor structures as reported in previous studies via confirmatory factor analyses (CFA) using structural equation modeling. Fourth, the present study further elucidates the psychometric properties of the SHAI. In a recent meta-analysis, Alberts et al. (2013) concluded that studies are needed to assess the instrument's test−retest reliability and "that researchers have not yet examined the usefulness of the SHAI in predicting future behaviors, [. . .] for example, [. . .] engagement in safety seeking behaviors over time" (p. 75). The present study answers this call by examining the test–retest reliability, predictive validity, and internal consistency of SHAI test scores with a longitudinal sample. Fifth, we examine invariance of the factor structure of the SHAI across subsamples of healthy and ill individuals to examine whether the concept of health anxiety as measured by the Dutch SHAI is interpreted equally in subgroups of healthy and ill people. Similarly, we examine whether the Dutch SHAI has the same meaning for men and women and when administered at different points in time. Finally, the association between age and health anxiety is examined.

The Factor Structure of the SHAI

The factor structure of the SHAI has been studied repeatedly, though such research has yielded inconsistent results. The short version of the SHAI was developed by selecting 14 items (Salkovskis et al., 2002) from the original 64 items (Warwick & Salkovskis, 1989) with the highest item-total correlations existing in patients with hypochondriasis. Furthermore, four items measuring the negative consequences of being ill were added to the main 14 items (Salkovskis et al., 2002). In the original study of Salkovskis et al. (2002), a principal component factor analysis yielded a two-factor solution (14 main items and four items measuring negative consequences). Alberts et al. (2013) demonstrated that several studies generally confirmed the SHAI's two-dimensionality: Factor 1, consisting of the first 14 items that pertain to the perceived likelihood of becoming ill (i.e., the Illness Likelihood subscale), and Factor 2, consisting of four items that pertain to the anticipated negative consequences of illness (the Negative Consequences of Illness subscale; Salkovskis et al., 2002).

Although studies examining the dimensionality of the SHAI have typically revealed a two-factor structure (Abramowitz et al., 2007a; Wheaton, Berman, Franklin, & Abramowitz, 2010a; Wheaton, Berman, & Abramowitz, 2010b; Zhang et al., 2015), some studies have revealed a three-factor solution (Abramowitz et al., 2007a; Abramowitz, Olatunji, & Deacon, 2007b; Morales et al., 2015; Olatunji, 2009) by splitting the perceived likelihood of becoming ill into Illness Likelihood (10 items) and Body Vigilance (four Items). The third factor pertains to Illness Severity (i.e., the same four items that form the Negative Consequences of Illness subscale, as described by Salkovskis et al., 2002). However, in two of these studies, the two-factor structure was eventually preferred based on parsimony (Abramowitz et al., 2007a; Morales et al., 2015). One study (Alberts, Sharpe, Kehler, & Hadjistavropoulos, 2011) solely examined the factor structure of the original 14 items proposed by Salkovskis et al. (2002) and confirmed two dimensions—Thought Intrusion (8 items) and Fear of Illness (5 items)—though only after dropping Item 14, which did not load on either factor. Further, Item 13 (If I notice an unexplained bodily sensation: 1. I do not find it difficult to think about other things; 2. I sometimes find it difficult to think about other things; 3. I often find it difficult to think about other things; 4. I always find it difficult to think about other things) appeared problematic in some studies because it either loaded on multiple factors (Wheaton et al., 2010a; Wheaton et al., 2010b) or did not strongly load on any factor (Abramowitz et al., 2007a). Finally, the addition of the Negative Consequences of Illness subscale has been called into question because this subscale does not assess health anxiety per se, but merely reflects the perception of consequences of developing illness (Alberts et al., 2013; Alberts et al., 2011).

On the basis of the meta-analysis and review of Alberts et al. (2013), we expected that the Dutch version of the SHAI would reveal a two-factor structure (Illness Likelihood, 14 items; Negative Consequences of Illness, 4 items). More specifically, because we wanted to account for the ordinal and non-normal nature of the data, we predicated our expectation of a two-factor structure on the results reported by Wheaton et al. (2010a) and Morales et al. (2015), who used analytical tools designed for categorical data. Although a two-factor solution seems evident, this dimensionality has not been uniformly found, and more insight is needed with regard to the precise factor structure and "behavior" of individual items. Therefore, we also tested alternative models.

The Reliability of SHAI Scores

Because test–retest reliability has been sparsely reported (Olatunji, Etzel, Tomarken, Ciesielski, & Deacon, 2011; Salkovskis et al., 2002; Zhang et al., 2015) and "should be investigated further" (Alberts et al., 2013, p. 75), another purpose of the current study was to assess reproducibility of SHAI test scores over time. The few existing studies that have examined test–retest reliability (Olatunji et al., 2011; Salkovskis et al., 2002; Zhang et al., 2015) have determined reproducibility via Pearson product–moment correlation coefficients. In the current study, we determined test–retest reliability by examining whether the SHAI produces similar test scores when administered at different points in time based on the intraclass correlation coefficient (ICC), a method that is preferred over the Pearson correlation coefficient (Deyo, Diehr, & Patrick, 1991). On the basis of previous studies, we also expected adequate internal consistency of SHAI scores (Alberts et al., 2013; Morales et al., 2015).

Reaching valid conclusions regarding test–retest reliability, on the basis of repeated measurements of SHAI scores at different time points, requires that the SHAI factor structure proves to be invariant over time (Kühne, 2013; Steenkamp & Baumgartner, 1998). In other words, a person's understanding of SHAI items should not change over time. We therefore first examined measurement invariance of the factor structure of the SHAI before determining test–retest reliability of SHAI scores. In the case of strong invariance, valid conclusions can be drawn regarding test–retest reliability and regarding comparisons of SHAI mean scores over time.

The Predictive Validity of SHAI Scores

On the basis of the cognitive-behavioral model of health anxiety (Abramowitz et al., 2007a; Abramowitz & Moore, 2007), the preoccupation with illness that people with high levels of health anxiety experience are fueled by misinterpretations of bodily sensations or symptoms. According to this model, people perform safety behaviors to reduce health-related fears. One of the most prominent safety behaviors is reassurance seeking, for example, visiting a doctor or seeking (online) health-related information (Abramowitz & Moore, 2007; Salkovskis et al., 2002; Salkovskis & Warwick, 1986; Warwick & Salkovskis, 1990). In the current study, we examined whether SHAI mean scale scores are predictive of online health-related information seeking (Baumgartner & Hartmann, 2011; Muse, McManus, Leung, Meghreblian, & Williams, 2012; Singh & Brown, 2014) and doctor visits (Barsky et al., 2001; Eastin & Guinsler, 2006).

Differences in SHAI Scores by Health Status, Gender and Age

According to Salkovskis et al. (2002), the SHAI can be used to assess (excessive) health anxiety, irrespective of people's actual health status. Therefore, SHAI scores should not differ between these groups; they should only vary on the basis of an individual's level of health anxiety. However, the study of Salkovskis et al. (2002) revealed that SHAI scores in medical samples were higher, thus corresponding, albeit to a small extent, to a person's actual health status. Furthermore, the meta-analysis of Alberts et al. (2013) confirmed that levels of health anxiety assessed using the SHAI are generally higher in medical samples. In line with Salkovskis et al. (2002) and Alberts et al. (2013), we expected individuals with illnesses to have slightly higher SHAI responses compared with those of healthy people.

To compare the levels of health anxiety in medical and nonmedical samples, interpretation of SHAI items must be invariant, that is, should have the same meaning in these different populations (Kühne, 2013; Steenkamp & Baumgartner, 1998). Alberts et al. (2011) demonstrated invariance of factor loadings of the SHAI factor structure across populations of healthy people and patients with multiple sclerosis. However, evidence of invariance across more general populations of ill people is lacking. Therefore, we examined measurement invariance of the factor structure of the Dutch SHAI in subsamples of healthy, temporarily ill and chronically ill people. In the case that strong measurement invariance is demonstrated, mean SHAI scale scores between these subsamples can be compared (Kühne, 2013; Steenkamp & Baumgartner, 1998).

In addition to examining measurement invariance of the factor structure of the SHAI across populations of healthy and ill people, we were also interested in invariance of the factor structure across men and women, in order to be able to compare their mean SHAI scores. On the basis of previous studies, we expected women to have slightly higher SHAI scores (Abramowitz et al., 2007a; Morales et al., 2015). Furthermore, we expected SHAI scores to correlate very weakly (Abramowitz et al., 2007a) or not at all (Morales et al., 2015; Wheaton et al., 2010b) with age. For this reason, we did not hypothesize measurement invariance across specific age groups.

In summary, the current study aimed to examine the psychometric properties, including the factor structure, measurement invariance, test–retest reliability, and predictive validity, of scores on a Dutch version of the SHAI.

Method

Participants and Procedure

The data for the present study were collected from the Longitudinal Internet Studies for the Social Sciences (LISS) panel administered by CentERdata (Tilburg University, The Netherlands). The LISS panel is a representative sample of Dutch individuals (aged 16 years and older) who participate in monthly Internet surveys. The panel is based on probability sampling of households from the population register (Scherpenzeel & Das, 2010; www.lissdata.nl). For the current study, we used data from two consecutive waves. In December 2013, 6,414 household members aged 16 years and older were randomly selected for participation in Wave 1. The questionnaire was completed by 5,310 members (an 82.8% response rate). For the confirmatory factor analysis, this sample was randomly split in half ($N = 2{,}653$ for Sample 1 and 2,657 for Sample 2). In February 2014, the respondents from Wave 1 were invited to participate in Wave 2 ($N = 5{,}297$). This questionnaire was completed by 4,647 members (a 12.3% dropout rate). The sample was again randomly split in half ($N = 2{,}322$ for Sample 1 and 2,325 for Sample 2). Within the four samples from Wave 1 and Wave 2, the total score of 27 or higher on the complete SHAI ranged between 2.0% and 2.8%. A total score of 27 or higher indicates severe health anxiety or clinical hypochondriasis (Abramowitz et al., 2007b; Alberts et al., 2013). These prevalence rates are comparable to the 1- to 2-year prevalence of severe health anxiety that has been found in community surveys and population-based samples (1.3% to 10%; American Psychiatric Association, 2013). See Table 1 for an overview of all the participant characteristics for the four samples.

Measures

Health anxiety. The original 18-item SHAI (Salkovskis et al., 2002) was translated into Dutch following a translate-retranslate protocol. In the first step, one of the authors translated the original

Table 1
Demographics, Online Health-Related Information Seeking, Health Care Utilization, and Health Anxiety Across Wave 1 and Wave 2 Data

Characteristic	Wave 1, split file 1 (N = 2,653) M (SD) or %	Wave 1, split file 2 (N = 2,657) M (SD) or %	Wave 2, split file 1 (N = 2,322) M (SD) or %	Wave 2, split file 2 (N = 2325) M (SD) or %
Gender				
Male	46.9	46.3	47.1	46.4
Female	53.1	53.7	52.9	53.6
Age	51.24 (17.62)	51.13 (17.46)	52.32 (17.45)	52.13 (17.30)
Education[ab]				
Low	35.7	32.5	36.3	33.7
Medium	33.3	34.9	33.5	34.3
High	31.0	32.6	30.2	32.0
Ethnic origin[a]				
Dutch background	84.3	84.4	85.1	85.5
First generation immigrants	6.1	6.2	6.1	6.0
Second generation immigrants	6.2	6.7	5.8	6.2
Missing	3.5	2.7	3.0	2.4
Online health-related information seeking in past two months	1.02 (2.43)	1.07 (2.55)	.94 (2.20)	.99 (2.42)
Number of doctor visits in past two months	1.09 (3.17)	1.00 (2.01)	.97 (2.20)	.97 (1.81)
SHAI[c]	11.30 (6.60)	11.23 (6.17)	10.50 (6.45)	10.66 (6.34)
SHAI ≥ 27[cd]	2.8	2.0	2.2	2.1

Note. SHAI = Short Health Anxiety Inventory.
[a] Distribution of education and ethnicity in our sample is comparable to the general Dutch population in 2013 (www.CBS.nl). [b] Low = *no/little vocational training*, medium = *advanced vocational training*, high = *college/university training.* [c] Means, standard deviations, and cut-off score of ≥ 27 are based on the sum score of the original 18-Item SHAI (Salkovskis et al., 2002). [d] Comparable to the 1- to 2-year prevalence of health anxiety in community surveys or population-based samples (1.3% to 10%; American Psychiatric Association, 2013).

items into Dutch. In the second step, a proficient English speaker, who was not familiar with the original items, performed back-translation from Dutch to English. In the third step, the retranslated items were compared to the originals. Thirteen of the items were identical or almost identical to the original wording, suggesting that the Dutch translation was reflective of the original item content. In five cases, there were discrepancies between the original and the retranslated version. The discrepancies were on the level of wording (e.g., "modern medicine" was retranslated as "regular medicine") or sentence construction (, e.g., "I do not have any difficulty . . ." was retranslated as "It is not difficult for me to . . ."). The discrepancies were discussed by the Dutch and English translator, which led to the rewording of the Dutch translation of three items.

Each item consisted of four statements that expressed different levels of intensity (e.g., 1. I do not worry about my health; 2. I occasionally worry about my health; 3. I spend much of my time worrying about my health; 4. I spend most of my time worrying about my health). For each item, respondents were asked to select the statement that best described their feelings over the last 2 months. The statements were scored on a categorical scale from 0 (*low health anxiety*) to 3 (*high health anxiety*). The total SHAI scores range from 0 to 54. The original scale used six months as a reference timeframe. We instead used a 2-month timeframe to make the SHAI applicable for the 2-month time lags in the present study. We specifically chose a 2-month time frame as this study is part of a larger project in which we investigate the longitudinal relationship between health anxiety and health-related behaviors. In such longitudinal designs it is of importance that time lags are not too long to prevent effects from declining over time (Dormann & Griffin, 2015). According to Salkovskis et al. (2002), a shorter time frame will furthermore increase the scales' sensitivity to changes over time. See online supplemental materials for the complete Dutch SHAI.

Online health-related information seeking. Respondents were asked to indicate on a scale from 0 to 21, how many times in the last 2 months they had searched online to find information regarding a specific health-related or medical problem that they had or thought that they might have (21 indicated searching more than 20 times).

Health care utilization. Respondents were also asked to indicate how many times (open-ended) they had visited a physician (general practitioner or specialist) in the last 2 months with regard to their own health.

Health status. Health status was measured in Wave 2 by two questions to determine whether participants currently suffered from a temporary medical condition (*yes/no*) and whether they currently suffered from a chronic medical condition (*yes/no*). The two items were combined into one item that indicated the respondent's current health status (healthy, temporarily ill, or chronically ill).

Statistical Analyses

To identify the factor structure of the Dutch SHAI, we conducted CFAs with a robust weighted least-squares estimator (WLSMV) using a diagonal weight matrix to account for the ordinal nature of the data (with Mplus 7 for structural equation modeling; Muthén & Muthén, 2012). We used a split-file procedure (SPSS version 23.0) on Wave 1 and Wave 2 data to divide both samples into two groups. Factor structures were compared in the first sample of Wave 1 data. We compared several factor solutions: (1) a one-factor model (18 items); (2) a two-factor model (Salkovskis et al., 2002); (3) a two-factor model, excluding Item 13 (Wheaton et al., 2010a; Wheaton et al., 2010b); (4) a three-factor model (Abramowitz et al., 2007b); and (5) a two-factor model based on the original 13 main items proposed by Salkovskis et al. (2002; Alberts et al., 2011). We determined model fit (Hu & Bentler, 1999) using chi-square tests ($p > .05$), the comparative fit index (CFI; >.95), the Tucker-Lewis Index (TLI; >.95), and the root-mean-square error of approximation (RMSEA; <.06). The chi-square model fit index was interpreted with caution because large sample sizes may result in high and significant chi-square values (Brown & Moore, 2012; Marsh & Balla, 1994). The CFA was repeated for the best fitting model in the second sample of Wave 1 data.

We used a polychoric correlation matrix produced in MPLUS 7 to examine the internal consistency of the SHAI, with ordinal alpha coefficients ($\alpha = [k^* r_{average}]/[1+(k-1)^* r_{average}]$) accounting for the ordinal nature of the data (Wave 1; Gadermann, Guhn, & Zumbo, 2012; Zumbo, Gadermann, & Zeisser, 2007). We conducted zero-inflated Poisson (ZIP) regression analyses in Mplus 7 to examine predictive validity (using complete Wave 1 and Wave 2 data). This type of analysis takes into account the excess of zeros often present in count data (Lambert, 1992), including online health-related information seeking (62.6% zeros) and the number of doctor visits (52.1% zeros) in the present study. Because of the non-normal distribution due to the ordinal nature of the data, nonparametric tests (Mann–Whitney *U* and Spearman's rho; SPSS 23) were used to compare SHAI scores based on health status (Wave 2, Sample 1) and to examine potential differences by gender and age (Wave 2, Sample 1). To examine the test–retest reliability (the reproducibility of test scores; Deyo et al., 1991), we computed single-case ICC test statistics (two-way random model, type absolute; SPSS 23) based on data from Wave 1 (Sample 2) and Wave 2 (Sample 2; Shrout & Fleiss, 1979). Test statistics above .40 indicate moderate reliability; test statistics above .60 indicate substantial reliability; and test statistics above .80 indicate excellent reliability (Fleiss & Cohen, 1973; Landis & Koch, 1977).

To determine measurement invariance of the SHAI factor structure across subsamples (health status/gender) and over time (Wave 1, Wave 2), we used a CFA procedure suitable for ordered categorical data (WLSMV with delta parameterization) following a three-step approach (Brown, 2015). We used a multi-Group CFA framework to determine invariance across subsamples (Wave 2, Sample 1). To examine longitudinal invariance we applied a single-group CFA framework in which we correlated the common latent factors and residuals of common factor indicators across Wave 1 (Sample 2) and Wave 2 (Sample 2; see online Supplement B). First the most optimal factor solution that resulted from the CFA was tested as a baseline model in the separate subsamples. Second, we examined configural invariance (factor loadings and intercepts free between groups/over time). Third, we examined strong invariance (factor loadings and intercepts constrained to be equal between groups/over time). We compared this model of strong invariance to the configural model with chi-square difference testing. In case of a nonsignificant chi-square difference, measurement invariance can be assumed, and means can be compared across groups/over time. Besides chi-square differences, we also interpreted changes in CFI (< .01 indicates invariance), and changes in RMSEA (< .015 indicates invariance) between the strong and configural models, since chi-square is subject to large sample size (Chen, 2007; Cheung & Rensvold, 2002). In case of full invariance, we used the strong invariance model to compare latent means. In case of a lack of full measurement invariance (large/significant changes in model fit between configural model and strong invariance model), we determined partial invariance by examining the modification indices. We used a stepwise approach, determining invariance by step-by-step releasing constraints on factor indicators and thresholds that appeared invariant based on modification indices (Steenkamp & Baumgartner, 1998). According to Steenkamp and Baumgartner (1998), a construct demonstrates measurement invariance when two or more indicators (including marker indicator) of this latent construct are invariant across populations or over time.

Results

The Factor Structure of the SHAI

A confirmatory factor analysis was conducted with the first sample of Wave 1 data ($N = 2{,}653$). Table 2 (Section A) shows the results for the five models that we initially tested. Based on fit indices, Model 4 demonstrated the best fit with its three-factor solution, as proposed by Abramowitz et al. (2007a); Abramowitz et al. (2007b) and Olatunji (2009): Illness Likelihood (10 items), Body Vigilance (4 items) and Negative Consequences of Illness (4 items). The original two-factor solution as proposed by Salkovskis et al. (2002) and the two-factor solution excluding Item 13 (based on Wheaton et al., 2010a) revealed moderate model fits, with CFI and TLI slightly lower than .95 and RMSEA higher than .06.

When examining the intercorrelations between the three factors, our results yielded a strong correlation between Factors 1 (Illness Likelihood) and 2 (Body Vigilance, $r = .84$) and moderate and acceptable correlations between Factors 1 and 3 (Negative Consequences of Illness, $r = .57$) and Factors 2 and 3 ($r = .51$). A further inspection of modification indices for the two-factor solution (Model 2) and the three-factor solution (Model 4) revealed correlated errors between Item 3 and Items 2 and 10 (items all refer to noticing/being aware of pain or bodily sensation/change), and between Items 5 and 12 (both items refer to serious illness). On the basis of this we repeated model tests for the two- and three-factor solutions, thereby including these correlated errors (see Table 2, Models 2a−4a). The two-factor solution (Model 2a) and the three-factor solution (Model 4a) revealed almost identical model fit, and we selected the two-factor solution as the final solution based on parsimony (Abramowitz et al., 2007a; Morales et al., 2015). Factor loadings are presented in Table 3. Factors 1 (Illness Likelihood) and 2 (Negative Consequences of Illness) correlated moderately ($r = .58$). This finding shows that the two factors are related but measure distinct elements of health anxiety.

Finally, we sought to reproduce the selected two-factor structure including correlated errors in the second group of Wave 1 data ($N = 2{,}657$). This analysis yielded the same adequate model fit: $\chi^2(131) = 927.541$ ($p < .001$), RMSEA = .048 (CI = .045-.051), CFI = .966, TLI = .960 (see Table 2, Section B). Again, Factors 1 and 2 correlated moderately ($r = .53$). Together, these findings confirm the two-dimensional structure of the Dutch version of the SHAI. We used this factor solution for the remaining analyses in the current study.

Table 2
Confirmatory Factor Analyses (CFA): Model Fit for Different Factor Solutions of the SHAI

Model	SHAI	χ^2	*df*	*p*	CFI	TLI	RMSEA (CI)	Probability RMSEA <.05
A[a]								
1	One-factor solution	3760.762	135	<.001	.872	.855	.101 (.098–.103)	.000
2	Two-factor solution	1571.179	134	<.001	.949	.942	.064 (.061–.066)	.000
2a	Two-factor solution with correlated errors[b]	907.134	131	<.001	.973	.968	.047 (.044–.050)	.938
3	Two-factor solution without Item 13[a]	1392.123	118	<.001	.950	.942	.064 (.061–.067)	.000
3a	Two-factor solution without Item 13, with correlated errors[b]	748.795	115	<.001	.975	.970	.046 (.042–.049)	.990
4	Three-factor solution	1322.012	132	<.001	.958	.951	.058 (.055–.061)	.000
4a	Three-factor solution with correlated errors[b]	884.676	129	<.001	.973	.968	.047 (.044–.050)	.953
5	Two-factor solution without Items 14–18	1132.339	64	<.001	.956	.946	.079 (.075–.083)	.000
B[c]								
8	Two-factor solution with correlated errors[b]	927.541	131	<.001	.966	.960	.048 (.045–.051)	.887

Note. SHAI = Short Health Anxiety Inventory; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; RMSEA = root mean square error of approximation.
[a] Data from Wave 1, Sample 1. [b] Item 3 with Items 2 and 10, Item 5 with Item 12. [c] Data from Wave 1, Sample 2.

Measurement Invariance Across Populations and Over Time

Table 4 presents the fit indices for the baseline model in the subsamples of healthy, temporarily ill and chronically ill people (Section A), males and females (Section B), and Wave 1 and Wave 2 (Section C). The baseline model revealed adequate model fit in all subsamples and in Wave 1 and Wave 2. Furthermore, Table 4 presents the fit indices for the configural and the strong invariance models.

Results regarding invariance of the factor structure across subsamples of healthy, temporarily ill and chronically ill people first revealed that the participants who were temporarily ill showed a different answering pattern compared to participants in the two other subsamples. Temporarily ill participants never selected the fourth answer category in four out of 18 questions. Multigroup CFA with categorical variables requires that every variable has the same values in each subsample, which is not the case in our sample of temporarily ill participants. A solution would be to collapse categories in all subsamples (i.e., ranging from 0 to 2 instead of 0 to 3). However, this changes the original structure of SHAI item scores. Instead, we therefore examined invariance of the SHAI factor structure across the subsamples of healthy and chronically ill people. The strong invariance model proved to have adequate model fit. Although the chi-square difference was significant, differences in CFI (<.01) and RMSEA (<.015) indicated that the strong invariance model did not lead to an unacceptable deterioration of model fit (see Table 4, Section A). The SHAI factor structure is thus invariant across subsamples of healthy and chronically ill people, and SHAI mean scores can be compared between these populations, but cannot be compared to SHAI mean scores of temporarily ill people.

Results regarding invariance of SHAI scores between men and women revealed adequate fit for the configural model as well as

Table 3
Confirmatory Factor Analysis (CFA): Standardized Factor Loadings

SHAI (Item)	Factor 1: Illness Likelihood	Factor 2: Negative Consequences of Illness
1. Worry about health	.75	
2. Noticing aches and pains	.54	
3. Awareness of bodily sensations/changes	.47	
4. Ability to resist thoughts of illness	.76	
5. Fear of having serious illness	.79	
6. Picturing self being ill	.80	
7. Ability to take mind off health thoughts	.84	
8. Relieved if doctor says nothing is wrong	.62	
9. Hear about illness and think I have it	.68	
10. Wonder what body sensations/changes mean	.55	
11. Feeling at risk for developing illness	.66	
12. Think I have a serious illness	.79	
13. Ability to think of other things if notice unexplained body sensations	.76	
14. Family/friends say I worry about my health	.43	
15. Ability to enjoy life if I have an illness		.75
16. Chance of medical cure if I have an illness		.65
17. Illness would ruin aspects of life		.79
18. Loss of dignity if I had an illness		.64

Note. Data from Wave 1, Sample 1. SHAI = Short Health Anxiety Inventory.

Table 4
Model Fit Indices for Measurement Invariance Models Across (Non-)Medical Samples, Men and Women, and Over Time

Model	χ^2	*df*	*p*	CFI	ΔCFI	TLI	RMSEA (90% CI)	P^d	ΔRMSEA	$\Delta\chi^2$	*df*	*p*
A[b]												
Baseline model healthy	468.851	131	<.000	.976	—	.972	.044 [.039, .048]	.993	—	—	—	—
Baseline model temporarily ill	220.547	131	<.000	.982	—	.979	.045 [.034, .055]	.791	—	—	—	—
Baseline model chronically ill	354.284	131	<.000	.971	—	.966	.052 [.046, .059]	.273	—	—	—	—
M1: configural invariance healthy vs. chronically ill	808.996	262	<.000	.975	—	.971	.046 [.042, .049]	.973	—	—	—	—
M2: full invariance healthy vs. chronically ill	1041.272	312	<.000	.966	.009	.967	.049 [.045, .052]	.759	.004	240.769	50	<.000
B[a]												
Baseline model male	376.669	131	<.000	.982	—	.979	.041 [.037, .046]	.998	—	—	—	—
Baseline model female	532.818	131	<.000	.973	—	.969	.050 [.046, .054]	.494	—	—	—	—
M1: configural invariance	912.447	262	<.000	.977	—	.974	.046 [.043, .050]	.970	—	—	—	—
M2: full invariance	857.470	312	<.000	.981	.004	.982	.039 [.036, .042]	1.000	.007	59.351	50	.17
C[bc]												
Baseline model Wave 1	794.288	131	<.000	.969	—	.964	.047 [.044, .050]	.959	—	—	—	—
Baseline model Wave 2	865.866	131	<.000	.970	—	.965	.049 [.046, .052]	.673	—	—	—	—
M1: configural invariance	2698.886	564	<.000	.962	—	.957	.040 [.039, .042]	1.000	—	—	—	—
M2: full invariance	7990.982	648	<.000	.869	.093	.872	.070 [.068, .071]	<.001	.030	2984.547	84	<.000
M3: partial invariance SHAI14	6761.750	643	<.000	.891	.071	.893	.064 [.063, .065]	<.000	.024	2386.057	79	<.000
M4: partial invariance SHAI 3	5794.292	638	<.000	.908	.054	.909	.059 [.058, .060]	<.000	.019	1903.744	74	<.000
M5: partial invariance SHAI2	5035.569	633	<.000	.921	.041	.922	.055 [.053, .056]	<.000	.015	1515.118	69	<.000
M6: partial invariance SHAI10	4247.724	628	<.000	.935	.027	.935	.050 [.048, .051]	.593	.010	1102.774	64	<.000
M7: partial invariance SHAI11	3703.970	623	<.000	.945	.017	.944	.046 [.045, .048]	1.000	.006	812.673	59	<.000
M8: partial invariance SHAI8	3368.604	618	<.000	.951	.011	.950	.044 [.042, .045]	1.000	.004	626.560	54	<.000
M9: partial invariance SHAI17	2954.513	613	<.000	.958	.004	.957	.041 [.039, .042]	1.000	.001	392.679	49	<.000

Note. CFI = confirmatory factor analysis; TLI = Tucker-Lewis Index; RMSEA = root mean square error of approximation; SHAI = Short Health Anxiety Inventory.
[a] Data from Wave 2, Sample 1. [b] Data from Wave 1, Sample 2, Wave 2, Sample 2. [c] Results based on $N = 2{,}325$, after merging Wave 1 (Sample 2) with Wave 2 (Sample 2). [d] Probability RMSEA < .05; baseline models are unconstrained; in configural models factor loadings and thresholds are freely estimated across groups/over time; in full invariance models factor loadings and thresholds are constrained to be equal across groups/over time.

for the strong invariance model. Furthermore, the strong invariance model did not lead to a deterioration in model fit as indicated by the nonsignificant chi-square difference and slight improvements in CFI and RMSEA (see Table 4, Section B). SHAI mean scores can thus be compared between men and women.

Results regarding invariance of SHAI scores over time revealed adequate fit indices for the configural model, however, we could not demonstrate full measurement invariance. Inspection of modification indices revealed that 7 items were invariant over time. After releasing constraints on these items in a stepwise approach (on Items 14, 3, 2, 10, 11, 8, and 17 in order of appearance) we could demonstrate partial longitudinal measurement invariance of the factor structure of the SHAI. The final model (Model M9 in Table 4, Section C) did not lead to a deterioration in model fit as indicated by the small changes in CFI (<.01) and RMSEA (<.015). SHAI mean scores can thus be compared over time.

The Reliability of SHAI Scores

Test–retest reliability. The single-case ICC for the Illness Likelihood subscale was .78, with a 95% confidence interval ranging from .76 to .80, indicating substantial to excellent test–retest reliability of test scores (Landis & Koch, 1977). The mean scores were 8.53 ($SD = 5.09$) in Wave 1 (Sample 2) and 8.10 ($SD = 5.16$) in Wave 2 (Sample 2). The single-case ICC for the Negative Consequences of Illness subscale was .67 at 2 months, with a 95% confidence interval ranging from .65 to .69, indicating substantial test–retest reliability of test scores (Landis & Koch, 1977). The mean scores were 2.93 ($SD = 2.09$) in Wave 1 and 2.83 ($SD = 2.09$) in Wave 2.

Internal consistency. Scores on the Illness Likelihood subscale revealed good internal consistency in both data samples of Wave 1 (ordinal coefficient $\alpha = .92$ and .91, respectively). Scores on the Negative Consequences of Illness subscale revealed adequate internal consistency (ordinal coefficient $\alpha = .79$ and .80, respectively).

The Predictive Validity of SHAI Scores

ZIP regression analyses were performed using Mplus 7 to examine whether mean scale scores of the SHAI (assessed in Wave 1) predicted two types of safety behaviors (in Wave 2), namely, online health-related information seeking and health care utilization (i.e., doctor visits; Abramowitz & Moore, 2007; Salkovskis et al., 2002; Salkovskis & Warwick, 1986; Warwick & Salkovskis, 1990). In both analyses, we entered age, gender, education level (low: no/little vocational training; medium: advanced vocational training; high: college/university training) and medical status (healthy, temporarily ill, or chronically ill) as control variables and SHAI subscale mean scores for Illness Likelihood and Negative Consequences of Illness as predictors. We report unstandardized regression coefficients, standard errors and 95% confidence intervals. ZIP regression analysis in Mplus 7 does not provide output regarding R^2.

ZIP regression analyses first test how predictors affect the likelihood of not engaging in a behavior at all (zero-inflation part) and then test how predictors affect the behavioral frequency. The results reveal that people scoring lower on Illness Likelihood were more likely to not engage in online health information seeking. For ease of interpretation we reversed the sign of the logit coefficient, whereby the results reveal that for a one-unit increase on the Illness Likelihood subscale, the odds of going online to find health information ($e^{.05}$) increase with 5% (when all other predictors are held constant). Furthermore, the frequency of online health information seeking, once initiated, increased with higher scores on the Illness Likelihood subscale, though not with higher scores on the Negative Consequences subscale. For a one-unit increase on the Illness Likelihood subscale, the predicted counts of going online ($e^{.04}$) increased by a factor of 1.04 (when all other predictors are held constant). See Table 5 for unstandardized regression coefficients, standard errors and 95% confidence intervals.

With regard to health care utilization, the results revealed that individuals scoring lower on Illness Likelihood were more likely to not visit a doctor. When reversing the sign, results show that for a one unit increase in Illness Likelihood, the odds of visiting a doctor in the past two months increased with 7% (when all other predictors are held constant). In addition, the number of doctor visits, once initiated, increased with higher scores on the Illness Likelihood subscale: For a one unit increase in Illness Likelihood, the predicted count of visiting a doctor ($e^{.04}$) increased by a factor of 1.04 (when all other predictors are held constant). Furthermore, the Negative Consequences of Illness subscale predicted the general occurrence of doctor visits, however, in the opposite direction. For a one-unit increase in Negative Consequences of Illness, occurrence of doctor visits decreased with 8%. The Negative Consequences of Illness subscale did not predict frequency of doctor visits once initiated. See Table 6 for unstandardized regression coefficients, standard errors and 95% confidence intervals.

Differences in SHAI Scores by Health Status, Gender and Age

Health status. Because results revealed that the SHAI factor structure is invariant for subsamples of healthy and chronically ill people, but not for temporarily ill people, only SHAI total scores for healthy and chronically ill people were compared.

Comparison of the latent means revealed that chronically ill participants, on average, scored .83 units higher than healthy participants on the Illness Likelihood factor ($p < .001$). Chronically ill participants scored .11 units higher than healthy participants on the Negative Consequences of Illness factor, but this difference was not significant ($p = .70$). A Mann–Whitney U test was conducted to compare composite sum scores on both subscales. Results revealed that chronically ill respondents scored significantly higher ($M = 10.33$, $SD = 5.80$) than healthy respondents did ($M = 6.53$, $SD = 4.59$) on the Illness Likelihood subscale, $z = 14.80$, $p = < .001$, ($r = .33$). No significant differences between chronically ill ($M = 2.64$, $SD = 2.11$) and healthy respondents ($M = 2.43$, $SD = 1.98$) were found for the Negative Consequences of Illness subscale ($z = 1.84$, $p = .07$, $r = .04$). The means and standard deviations for the medical and nonmedical samples are depicted in Table 7.

Gender and age. Comparison of the latent means revealed that women, on average, scored .33 units higher than men on the Illness Likelihood factor ($p < .001$) and .11 units higher than men on the Negative Consequences of Illness factor, although this difference was borderline significant ($p = .047$). A Mann–Whitney U test was conducted to compare composite sum scores on both subscales. Regarding the Illness Likelihood subscale, the results of the test were in the expected direction and were significant, $z = 6.05$, $p = < .001$, ($r = .13$). Women scored significantly higher ($M = 8.51$, $SD = 5.27$) than men did ($M = 7.42$, $SD = 5.40$) on the Illness Likelihood subscale. No significant difference between males ($M = 2.47$, $SD = 2.05$) and females ($M = 2.56$, $SD = 1.20$) was found for the Negative Consequences of Illness subscale ($z = 1.81$, $p = .07$, $r = .04$).

Age was not significantly associated with Illness Likelihood ($r_s = -.002$, $p = .92$), but it showed a negative but weak correlation with Negative Consequences of Illness ($r_s = -.07$, $p <$

Table 5
Predictors of Online Health-Related Information Seeking

Predictor	Prediction of absence of online health information seeking[a]			Prediction of frequency of online health information seeking[b]		
	b	*SE b*	95% CI	*b*	*SE b*	95% CI
Gender	−.32**	.08	[−.48, −.17]	.12	.08	[−.04, .27]
Age	.01**	.00	[.01, .02]	.00	.00	[−.00, .00]
Education level						
High vs. low	.26**	.10	[.07, .45]	−.17	.09	[−.34, −.00]
High vs medium	.00	.09	[−.18, .19]	−.01	.09	[−.18, .17]
Health status						
Chronically ill vs healthy	−1.37***	.11	[−1.58, −1.16]	.36***	.09	[.18, .55]
Chronically ill vs temporarily ill	−.83***	.10	[−1.02, −.65]	.23**	.10	[.04, .42]
SHAI—Illness Likelihood	−.05***	.01	[−.07, −.04]	.04***	.01	[.03, .06]
SHAI—Negative Consequences of Illness	−.03	.02	[−.07, .02]	−.01	.02	[−.05, .04]

Note. Gender, age, education (low = *no/little vocational training*, medium = *advanced vocational training*, high = *college/university training*). Short Health Anxiety Inventory (SHAI)—Illness Likelihood and SHAI—Negative Consequences of Illness were measured in Wave 1; health status and online health information seeking (dependent variable) were measured in Wave 2 (2 months after Wave 1); gender was coded as 1 = male, 2 = female; education level was coded as 0 = high, all other = 1; health status was coded as 0 = healthy, all other = 1.
[a] Logit: Predicting membership to the zero group. [b] Poisson model: Predicting the amount of online health information seeking once initiated.
** $p < .01$. *** $p < .001$.

Table 6
Predictors of Health Care Utilization (Number of Doctor Visits in the Last 2 Months)

Predictor	Prediction of absence of doctor visits[a]			Prediction of frequency of doctor visits[b]		
	β	*SE* β	95% CI	β	*SE* β	95% CI
Gender	−.11	.11	[−.32, .10]	−.00	.07	[−.14, .14]
Age	−.02***	.00	[−.03, −.02]	.00	.00	[−.00, .01]
Education level						
High vs. low	−.26	.14	[−.52, .01]	.06	.10	[−.13, .25]
High vs. medium	−.13	.13	[−.39, .13]	−.03	.09	[−.21, .16]
Health status						
Healthy vs. temporarily ill	−1.34***	.15	[−1.63, −1.05]	.70***	.11	[.49, .91]
Healthy vs. Chronically ill	−1.18***	.13	[−1.44, −.93]	.49***	.08	[.32, .65]
SHAI—Illness Likelihood	−.07***	.01	[−.09, −.04]	.04***	.01	[.02, .06]
SHAI—Negative Consequences of Illness	.08**	.03	[.02, .13]	−.01	.02	[−.04, .03]

Note. Gender, age, education (low = *no/little vocational training*, medium = *advanced vocational training*, high = *college/university training*). Short Health Anxiety Inventory (SHAI)—Illness Likelihood and SHAI—Negative Consequences of Illness were measured in Wave 1; health status and online health information seeking (dependent variable) were measured in Wave 2 (2 months after Wave 1); gender was coded as 1 = male, 2 = female; education level was coded as 0 = high, all other = 1; health status was coded as 0 = healthy, all other = 1.
[a] Logit: Predicting membership to the zero group. [b] Poisson model: Predicting the amount of online health information seeking once initiated.
** $p < .01$. *** $p < .001$.

.01). Older respondents tended to score slightly lower on the *Negative Consequences* subscale.

Discussion

In the current study, we used a large nation-wide sample to examine the psychometric properties, including the factor structure, measurement invariance, test–retest reliability, and predictive validity, of scores on a Dutch version of the SHAI. Overall, our results suggest adequate internal consistency and test–retest reliability of test scores as well as a two-factor structure for the Dutch SHAI. Furthermore, the SHAI factor structure proved to be invariant across healthy and chronically ill people, males and females, and revealed partial measurement invariance over time. To the best of our knowledge, this is the first study to examine the predictive validity of scores on both SHAI factors (Illness Likelihood and Negative Consequences of Illness) and control for alternative predictors in a representative nation-wide sample. In addition, the findings showed that people who were chronically ill and females scored higher on the Illness Likelihood subscale and that younger people scored slightly higher on the Negative Consequences of Illness subscale. This study found prevalence rates for severe health anxiety (clinical hypochondriasis) that are comparable to the prevalence rates observed in community surveys and population-based samples (1.3% to 10%; American Psychiatric Association, 2013). In summary, our results show that the scores on the SHAI have good psychometric properties and the present interpretation of test scores is valid. The findings provide evidence for the applicability of the SHAI in the general Dutch population.

The Factor Structure of the SHAI

Similar to those of Morales et al. (2015), our results show a poor model fit for a one-factor solution (all 18 items). Our results regarding the two-factor solution of the SHAI are in line with previous studies. Wheaton et al. (2010a) and Wheaton et al. (2010b) also provided evidence of a two-factor solution after discarding Item 13. On the basis of our findings, we suggest retaining Item 13 because exclusion did not improve the model fit. We also obtained a three-factor solution with a good model fit, but we suggest relying on the two-factor solution based on parsimony, in line with Abramowitz et al. (2007a) and Morales et al. (2015). We did not find support for a two-factor solution based on the first 13 items of the SHAI, as proposed by Alberts et al. (2011).

Our results revealed correlated errors between the items that measure aspects of body vigilance (Items 2, 3, and 10). These items together have previously been referred to as the Body Vigilance subscale (Abramowitz et al., 2007a; Abramowitz et al., 2007b; Morales et al., 2015; Olatunji, 2009). This subscale was originally revealed by exploratory factor analyses, in which it is not possible to specify correlated errors (Brown, 2015). On the basis of our results, we argue that this subscale might constitute a method factor (Brown, 2015), since the items assessed by this factor contain similar wording (i.e., they all refer to noticing/being aware of pain or bodily sensation/change). This conclusion is in line with the conclusion of Alberts et al. (2013), who state that the Body Vigilance subscale seems unreliable

Table 7
Means and Standard Deviations of Illness Likelihood and Negative Consequences of Illness Subscales for Healthy, Temporarily and Chronically Ill Respondents

Measure	*M*	*SD*
Illness Likelihood	7.99	5.36
Healthy	6.53	4.59
Temporarily ill[a]	9.55	5.41
Chronically ill	10.33	5.80
Negative Consequences of Illness	2.52	2.00
Healthy	2.43	1.98
Temporarily ill[a]	2.63	1.90
Chronically ill	2.64	2.11

Note. Wave 2, file 1; $N = 2{,}322$.
[a] Due to a lack of measurement invariance of Short Health Anxiety Inventory (SHAI) scores in temporarily ill people, means for this subsample cannot be compared with mean SHAI scores of samples of healthy and chronically ill people.

and should not be considered a distinct subscale. However, body vigilance-based anxiety is an important aspect of the cognitive-behavioral model of hypochondriasis (Abramowitz et al., 2007a; Abramowitz & Moore, 2007). Accordingly, it may be worthwhile to construct and test a possible Body Vigilance subscale that assesses anxiety resulting from an individual's awareness of his or her body, in future studies (e.g., by incorporating items from the Body Vigilance Scale, BVS; Olatunji, Deacon, Abramowitz, & Valentiner, 2007; Schmidt, Lerew, & Trakowski, 1997).

The two-factor solution further proved to be invariant across subsamples of healthy and chronically ill people and males and females. In addition, the factor structure proved to be partially invariant over time. According to Steenkamp and Baumgartner (1998), only two invariant indicators are necessary to allow for testing latent mean differences. However, it should be noted that determining partial invariance is an explorative procedure (Brown, 2015) and may not be a sufficient condition for the comparison of SHAI sum scores, because differences in thresholds and factor loadings of indicators between groups can influence the composite score (Steinmetz, 2013). Thus, even when latent means are not different, observed means might appear different when the construct is noninvariant. Furthermore, according to Chen (2008), the majority of indicators on a latent construct should be invariant to secure validity and allow for meaningful comparisons of latent means. In the current study, eight out of 14 items on the Illness Likelihood subscale and three out of four items on the Negative Consequences of Illness subscale proved to be invariant over time. On the basis of this, we conclude that latent means on the subscales can be compared over time (Brown, 2015; Steenkamp & Baumgartner, 1998), but caution should be exercised when comparing observed scores.

Reliability of SHAI Scores

The ICC test statistics indicated the excellent test–retest reliability of scores on the Illness Likelihood subscale and the adequate reliability of scores on the Negative Consequences of Illness subscale after 2 months. The internal consistency of scores on the SHAI subscales was adequate. The scores on the Illness Likelihood subscale revealed high internal consistency, as reported in previous studies (Morales et al., 2015; Salkovskis et al., 2002; Wheaton et al., 2010a). The scores on the Negative Consequences of Illness subscale revealed less, though still good, reliability, as reported in previous studies (Morales et al., 2015; Salkovskis et al., 2002; Wheaton et al., 2010a).

Although scores on the Illness Likelihood subscale already yielded very good reliability, and the factor structure of the SHAI proved to be partially invariant over time, some problematic wording issues should be addressed. In Wave 1, the respondents indicated that they found answering or interpreting some SHAI items difficult, which may explain the variability between measurements. The respondents might have misinterpreted some items, possibly resulting in different interpretations on different test occasions. The specific items mentioned by these respondents further revealed to be variant over time, indicating different interpretations over time. Therefore, rewording several items might further improve the reliability of SHAI scores (Drost, 2011).

Item Wording

The SHAI is developed as a measurement tool that is sensitive to normal levels of health anxiety but also to clinical hypochondriasis (Salkovskis et al., 2002). However, reframing response options such that the absence of worry about health can also be an outcome may further improve the wording of some items. For example, in our study, the respondents in Wave 1 found answering Item 8 (1. I am lastingly relieved if my doctor tells me that there is nothing wrong; 2. I am initially relieved, but the worry sometimes returns; 3. I am initially relieved, but the worry always returns; 4. I am not relieved if my doctor tells me that there is nothing wrong) difficult because the answer categories did not reflect their particular situation, that is, they did not feel worried or distressed when visiting the doctor (indicating no health anxiety). In Wave 2, we thus offered respondents the opportunity to indicate that they did not worry when visiting the doctor. A large group (41.75% of the sample in Wave 2) opted for this additional answer. This group also scored significantly lower on all other items of the SHAI compared with people who opted for the standard four response categories of Item 8. Therefore, we recommend the careful rewording of the four response options of Item 8 (i.e., not inclusion of a fifth response option), such that individuals who do not worry about their health can also answer this question appropriately.[2]

Items 10 and 11 have similar wording issues. For example, Item 10 implies that even individuals who are not anxious about their

[2] Some respondents in Wave 1 reported having trouble answering Item 8 of the SHAI (1. I am lastingly relieved if my doctor tells me that there is nothing wrong; 2. I am initially relieved, but the worry sometimes returns; 3. I am initially relieved, but the worry always returns; 4. I am not relieved if my doctor tells me that there is nothing wrong). These respondents indicated that they did not feel worried when visiting a doctor; therefore, they could not feel more or less relieved after seeing their doctor. Each item of the original SHAI consisted of four statements, and respondents were asked to select the statement that best described their feelings over the past two months. In Wave 2, we added a fifth statement to Item 8: "Not applicable; I do not feel worried when I visit my doctor." In Wave 2, a large proportion of the respondents (N = 1,940, 41.75%) chose this response option, and these respondents differed significantly from other participants; they were slightly younger, were more often male, searched less often online for health-related information over the past two months, visited their doctor less often over the past two months, were more often healthy than ill and scored lower on the 17 remaining items of the SHAI.

A similar remark was made by respondents from Wave 1 regarding Item 2 (1. I notice aches/pains less often than most other people (of my age) do; 2. I notice aches/pains as much as most other people (of my age) do; 3. I notice aches/pains more often than most other people (of my age) do; 4. I am aware of aches/pains in my body all the time). In Wave 2, we added a fifth statement to Item 2: 'I don't know'. In Wave 2, 239 respondents (11.11%) choose this response option, and they differed significantly from the other participants; they were younger, were more often healthy than ill and scored lower on six of the 16 remaining items of the SHAI (excluding Items 2 and 8).

We decided to recode the answer options "I don't know" (Item 2) and "Not applicable; I do not feel worried when I visit my doctor" (Item 8) and assigned them the value 0, which is the lowest item score on the individual SHAI items, indicating low health anxiety. We used the recoded items for the analyses in the current study. In addition, we repeated all analyses in the subsample of participants who did not select (one of) the two added answer options (N = 2,600, 55.95%). Only results regarding predictive validity slightly differed from results regarding the complete sample. In the subsample, scores on the Negative Consequences of Illness subscale predicted occurrence of online health-related information seeking, although this effect was rather small: for a one-unit increase on the Negative Consequences of Illness subscale, the odds of going online to find health information increased with 6%. This effect could not be demonstrated in the complete sample. Furthermore, results revealed that in the subsample, the Negative Consequences of Illness subscale did not predict occurrence of doctor visits, although this effect was demonstrated in the complete sample.

health wonder what a bodily sensation or change means (If I have a bodily sensation or change I: 1. rarely wonder what it means). Therefore, we suggest that the four response options for Items 10 and 11 be reworded to ensure that people can indicate that they never wonder what a bodily sensation or change means (Item 10) and/or that they never feel at risk for developing a serious illness (Item 11). Such rewording is in line with the first answer categories of all other items, which always include words such as 'never,' 'I am not,' and 'I do not have.' Last, we also recommend rewording Item 2 to improve respondents' understanding of the item (see Footnote 2).

The Predictive Validity of SHAI Scores

The present study provides new insight into the predictive validity of SHAI scores. The only other study that investigated the predictive validity of SHAI scores used a cross-sectional design and small student sample with the proposed outcomes measured in retrospect (medical utilization and safety seeking; Abramowitz et al., 2007a). In the current study, we used a longitudinal design to measure health anxiety, along other known important predictor variables, in Wave 1, and health care utilization and online health-related information seeking two months later in Wave 2.

Our results revealed that scores on the Illness Likelihood subscale predicted the frequency of online health-related information seeking and health care utilization. This finding suggests that future studies examining health anxiety as a predictor of the extent to which individuals perform safety behaviors, such as doctor visits or information seeking, should apply the 14-item SHAI, as proposed in the current study. These results are in line with the results of Abramowitz et al. (2007a). In addition, our results revealed that scores on the Illness Likelihood subscale are predictive of both the occurrence and the frequency of safety behaviors. Although we find predictive effects, these effects were also fairly small and should therefore be interpreted with care.

Our results further revealed that scores on the Negative Consequences of Illness subscale merely predict absence of doctor visits. In terms of reassurance seeking, our results seem to indicate that people who perceive many negative consequences of illness tend to avoid rather than seek reassurance with their doctor. This may well be meaning that the Negative Consequences of Illness subscale reflects a different type of safety seeking than reassurance seeking, namely avoidance of stimuli or situations associated with illness (Abramowitz et al., 2007a; Abramowitz, Schwartz, & Whiteside, 2002). In the *DSM-5* this is referred to as the *care-avoidant' type of illness anxiety* (see Footnote 1; American Psychiatric Association, 2013): "The individual performs excessive health-related behaviors (e.g., repeatedly checks his or her body for signs of illness) or exhibits maladaptive avoidance (e.g., avoids doctor appointments and hospitals [i.e., care-avoidant type])" (p. 315). To determine whether health anxiety is characterized by different subtypes, such as an avoidant subtype of health anxious people which is indicated by higher scores on the Negative Consequences of Illness subscale, one would have to rely on different analytical techniques, for example latent class analysis. This is, however beyond the scope of the current study.

Differences in SHAI Scores by Health Status, Gender, and Age

The scores on the Illness Likelihood subscale were sensitive to the respondents' objective health statuses, indicating that chronically ill people have elevated levels of health anxiety compared with those of healthy individuals. This finding suggests that the SHAI is responsive, albeit only to a slight degree, to individuals' actual health statuses. Although this finding is in line with those of previous research (Alberts et al., 2011; Salkovskis et al., 2002), it does not reflect the conceptual goal of the SHAI, which is to assess health anxiety independent of actual health status (Salkovskis et al., 2002).

Data in the current study did not allow for the examination of measurement invariance of the factor structure of the SHAI in a subsample of people who were temporarily ill. Consequently, we could not compare mean SHAI scores in this subsample with mean SHAI scores in healthy and chronically ill subsamples. Additional research is needed to further examine how temporarily ill people interpret SHAI items.

In line with previous studies (Abramowitz et al., 2007a; Morales et al., 2015), women were slightly more health anxious than men were, as indicated by their higher scores on the Illness Likelihood subscale. Latent means on the Negative Consequences of Illness subscale were significantly higher for women than for men. Sum scores on this subscale, however, did not differ significantly for men and women. Although latent mean difference testing is more powerful in detecting significant differences (Steinmetz, 2013), the current difference was only borderline significant and may, in light of the large sample size, be neglected. Finally, younger people scored higher on the Negative Consequences of Illness subscale. Abramowitz et al. (2007a) revealed a similar (negative but weak) correlation between the total score of the 18-item SHAI and age.

Limitations

Some limitations of our study must be noted. First, based on the feedback obtained from many respondents in Wave 1, we added answer options for Items 2 and 8 in Wave 2, thereby slightly adjusting the original scale (see Footnote 2). To test the original scale, we had to recode answer options for Items 2 and 8. Respondents who opted for the added answer options scored lower on overall health anxiety and were more often healthy compared with other respondents. While our adaptation and recoding may be interpreted as a limitation of the present approach, it was based on respondents' problems with the original answer options for Items 2 and 8, which revealed that both items might need careful rewording.

In line with Alberts et al. (2013), we determined the prevalence of severe health anxiety based on a cut-off score of 27 or higher on the complete 18-Item SHAI. However, in the literature, no consensus exists regarding cut-off scores, with scores as low as 15 (Tang, Wright, & Salkovskis, 2007; Zhang et al., 2015) or as high as 38 (Sulkowski, Mariaskin, & Storch, 2011) applied to indicate clinically significant health anxiety (Alberts et al., 2013). We suggest a taxometric analysis (in accordance with Alberts et al., 2013) or latent class analysis to achieve a better understanding of possible cut-off scores in the future, thereby taking into account the factor structure of the SHAI, as proposed in the current study.

Conclusion

The present study provides empirical evidence for the factorial and predictive validity, the test–retest reliability, and the internal consistency of scores on the Dutch SHAI, thereby proving that it is a useful tool for measuring health anxiety in the general population. Based on our results, we recommend that particularly the 14-Item SHAI—that is, the Illness Likelihood subscale, as proposed in the current study —should be adopted to measure health anxiety in future studies and clinical settings. We suggest slight adaptations to some of the answer options to account for individuals who are not anxious about their health. In line with Alberts et al. (2013), we conclude that the benefit of adding the Negative Consequences of Illness subscale (i.e., the last four items of the original scale developed by Salkovskis et al., 2002) is debatable.

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Received October 9, 2015
Revision received March 28, 2016
Accepted March 31, 2016 ■