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Psychometric Evaluation of the Multidimensional Inventory of Hypochondriacal Traits: Factor Structure and Relationship to Anxiety Sensitivity

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The Multidimensional Inventory of Hypochondriacal Traits (MIHT; Longley, Watson, & Noyes, 2005) appears to address shortcomings of other common measures of health anxiety, but further research is required prior to using this measure in treatment planning and outcome assessment. This study was designed to explore the hierarchical structure of this health anxiety measure and relations of the various MIHT health anxiety components to anxiety sensitivity. A sample of 535 university students (362 women) was administered the 31-item MIHT and the 16-item Anxiety Sensitivity Index (ASI; Reiss, Peterson, Gursky, & McNally, 1986). Confirmatory factor analyses of participants' responses on the MIHT showed that this measure may be conceptualized either as involving four correlated factors (i.e., Affective, Cognitive, Behavioral, and Perceptual) or as being hierarchical in nature, with the four lower-order factors loading on a single higher-order global health anxiety factor. Correlational analyses revealed significant relations of anxiety sensitivity to each of the four MIHT subscales and to the MIHT total score. Of the three established anxiety sensitivity components, ASI Physical Concerns were most strongly and consistently related to the various dimensions of health anxiety on the MIHT. Additional analyses revealed that the ASI and MIHT are better represented as two correlated but independent traits as opposed to common manifestations of a single underlying trait. The

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results have implications for case conceptualization, treatment planning, and assessment of treatment outcome in cognitive psychotherapy with health-anxious populations.

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Hypochondriasis refers to marked and persistent fears of having or beliefs that one has a serious illness or disease (American Psychiatric Association [APA], 2000). Such fears are triggered and maintained by the catastrophic misinterpretation of common bodily symptoms such as rashes or lumps. The preoccupation with illness does not respond to reassurance provided by others (e.g., physicians) and causes the individual with hypochondrias substantial distress (APA, 2000). Hypochondriasis is very costly to the health care system given its association with increased use of medical services, including unnecessary physician visits, tests, and procedures (Smith, 1994). Many experts today argue for a dimensional operationalization of hypochondriasis (e.g., Creed & Barsky, 2004) where health anxiety is seen to lie on a continuum ranging from low health anxiety to severe health anxiety (a subthreshold condition) to clinical hypochondriasis.[1]

Several theoretical models endeavor to explain the development, maintenance, and optimal treatment of severe health anxiety and hypochondriasis. These include cognitive-behavioral (e.g., Abramowitz, Schwartz, & Whiteside, 2002; Taylor & Asmundson, 2004; Warwick & Salkovskis, 1990; Williams, 2004) as well as interpersonal (Noyes et al., 2003) models. Regardless of theoretical perspective, there is general agreement that the essential components of health anxiety include the following: (a) an "affective component" involving fear or worries about illness and disease, (b) a "cognitive component" involving conviction that one is ill despite contrary evidence, (c) a "perceptual component" involving preoccupation with bodily symptoms and somatic absorption, and (d) a "behavioral component" involving such responses as bodily checking, avoidance of illness-related cues, and reassurance seeking (e.g., Longley, Watson, & Noyes, 2005; Stewart & Watt, 2001).

Several measures of health anxiety exist (see review by Stewart & Watt, 2001). These include the Whiteley Index (WI; Pilowsky, 1967), Illness Attitudes Scales (IAS; Kellner, 1987; Kellner, Abbott, Winslow, & Pathak, 1987), Somatosensory Amplification Scale (SSAS; Barsky, Wyshak, & Klerman, 1990), Health Anxiety Questionnaire (HAQ; Lucock & Morely, 1996), and Health Anxiety Inventory (Salkovskis, Rimes, Warwick, & Clark, 2002). However, none of these measures adequately captures all four of the key components of health anxiety (Longley et al., 2005; Stewart & Watt, 2001). The absence of a sound, comprehensive measure of the various health anxiety domains poses a problem for therapists working with health-anxious patients. In particular, case conceptualization, treatment planning, and assessment of treatment outcome are much more difficult than necessary.

Factor-analytic studies of the most commonly used self-report measure of health anxiety, the IAS (Kellner, 1987; Kellner et al., 1987), demonstrate that this measure is comprised of a smaller set of factors than the nine scales originally suggested by Kellner (e.g., Hadjistavropoulos & Asmundson, 1998). Using exploratory principal components analysis (PCA), Stewart and Watt (2000) found that the IAS assesses four factors tapping: illness fears (an affective component), hypochondriacal beliefs (a cognitive component), health habits and treatment seeking (a behavioral component), and negative effects of illness. Hadjistavropoulos, Frombach, and Asmundson (1999) used confirmatory factor analyses (CFAS) to show that the structure of the IAS may be conceptualized as either four distinct but intercorrelated lower-order factors or as hierarchical in nature with the four lower-order factors loading onto a single higher-order global health anxiety factor. Conspicuously absent from the IAS are discrete measures of reassurance-seeking behavior and the perceptual anomaly of somatic absorption that are characteristics of many patients with hypochondriasis (Stewart & Watt, 2001).

The Multidimensional Inventory of Hypochondriacal Traits (MIHT; Longley et al., 2005) was developed as an alternative self-report measure of hypochondriacal concerns and was designed to overcome several of the limitations of existing health anxiety measures such as the IAS. Therapists are likely to find this scale of greater utility in assessment and treatment of health-anxious patients since it appears to tap all the core dimensions of hypochondriacal traits identified in the literature (i.e., affective, cognitive, perceptual, and behavioral). Nonetheless, further research is required on this tool prior to its use within the therapeutic context. In particular, research has yet to examine the potential hierarchical structure of the MIHT. As has been shown for the IAS (see Hadjistavropoulos et al., 1999), a possible alternative structure to the correlated four-factor model supported in Longley et al. (2005) is a hierarchical structure involving a set of four lower-order factors (i.e., in this case, Affective, Cognitive, Behavioral, and Perceptual). In such a hierarchical structure, each of these four factors is hypothesized to load significantly onto a higher-order factor representing the global health anxiety construct. In both such models, four distinct health anxiety components are proposed. However, differences exist in the way in which the relations between these components are conceptualized across these two models. In the correlated four-factor model (Longley et al., 2005), the relations between the four MIHT components may be seen as a Venn diagram consisting of four circles, each of which overlaps with the other three to some degree. The hierarchical model, in contrast, suggests that the relationship between the factors is due to each of the four factors being related to a common, "general" factor, as in hierarchical models of the structure of intelligence (e.g., Vernon, 1969). This distinction is important clinically because only the hierarchical model is consistent with scoring of both MIHT subscales (consistent with the lower-order factors) and a total MIHT score representing overall severity of health anxiety (consistent with the higher-order factor). If a hierarchical model is not supported, then use of a total MIHT score may be inappropriate (see Hadjistavropoulos et al., 1999).

Also of critical importance in validation of the MIHT is to examine its relationship with anxiety sensitivity. Anxiety sensitivity is a construct with substantial relations to hypochondriasis and health anxiety and is commonly measured with the Anxiety Sensitivity Index (ASI; Reiss, Peterson, Gursky, & McNally, 1986). Anxiety sensitivity refers to a fear of anxiety-related sensations due to beliefs that these sensations have harmful consequences (Reiss et al., 1986). In studies using the IAS (Kellner, 1987) to tap health anxiety, anxiety sensitivity appears to be a good predictor of hypochondriacal concerns among panic-disordered patients (Otto, Pollack, Sachs, & Rosenbaum, 1992), depressed patients (Otto, Demopulos, McLean, Pollack, & Fava, 1998), elderly persons (Bravo & Silverman, 2001; Frazier & Wade, 1999), and university students (Stewart & Watt, 2000). Some have suggested that anxiety sensitivity might act as a vulnerability factor not only for panic disorder but also for the development of health anxiety and hypochondriasis (Watt & Stewart, 2000; Watt, Stewart, & Cox, 1998). Furer, Walker, Chartier, and Stein (1997) failed to find significantly elevated anxiety sensitivity levels among a sample of 10 patients with comorbid panic disorder plus hypochondriasis (mean [*SD*] ASI = 37.2 [14.8]) relative to a sample of 11 patients with panic disorder only (mean [*SD*] ASI = 29.8 [8.2]). Nonetheless, consistent with the suggested role of anxiety sensitivity in hypochondriasis, calculation of the moderate effect size involved (i.e., Cohen's $d = .62$ [Cohen, 1992]) suggests that the Furer et al. (1997) study may have simply been underpowered to detect this hypothesized group difference. Stewart and Watt (2000) have argued that the magnitude of the relations observed between anxiety sensitivity and health anxiety in prior studies suggests that the two are overlapping yet distinct constructs; however, research has yet to test this assertion directly.

Only one study to date has examined relations of anxiety sensitivity to the various components of health anxiety. Specifically, Stewart and Watt (2000) found that only three of the four IAS factors (i.e., all but the behavioral component) were significantly related to anxiety sensitivity. This is of concern since one would anticipate that anxiety sensitivity should correlate significantly with all components of health anxiety, including hypochondriacal behaviors. However, the IAS has been criticized as a poor measure of hypochondriacal behavior, as health habits items (e.g., avoidance of unhealthy food) are not part of the clinical definition of hypochondriasis (Hadjistavropoulos et al., 1999; Stewart & Watt, 2001). The MIHT (Longley et al., 2005) has yet to be studied in relation to anxiety sensitivity, but if it is indeed a superior measure of the various dimensions of health anxiety, then anxiety sensitivity should relate to all the MIHT scales.

The present study was designed to examine further the factor-analytic structure of the MIHT and to provide additional evidence of its validity by examining its relationship to anxiety sensitivity. The MIHT and the ASI (Reiss et al., 1986) were administered to a large sample of undergraduates. There were four purposes of the study. First, we wanted to further explore the factor structure of the MIHT, including an examination of its hierarchical structure. Second, we set out to directly test Stewart and Watt's (2000) assertion that anxiety sensitivity and health anxiety are correlated yet distinct constructs. Third, we intended to examine the relations of anxiety sensitivity to each MIHT factor to replicate previous results that anxiety sensitivity is significantly related to the affective and cognitive components of the hypochondriacal tendency (Stewart & Watt, 2000) and to explore the additional hypotheses that anxiety sensitivity would also be significantly related to the behavioral component of the MIHT (reassurance seeking) as well as the perceptual component (somatic absorption). Finally, we wanted to examine the relations of the various anxiety sensitivity components (i.e., physical, cognitive, and social concerns; Stewart, Taylor, & Baker, 1997) to each lower- and higher-order MIHT dimension. We hypothesized that, of the three ASI subscales, the ASI Physical Concerns scale would be the strongest predictor of each of the MIHT dimensions in multiple regression analyses, given theory regarding the role of ASI Physical Concerns in hypochondriasis (Cox, Borger, & Enns, 1999).

METHOD

Participants

Participants were 535 undergraduate university student volunteers at Saint Francis Xavier University in the Canadian province of Nova Scotia. The gender composition was 67.7% female. On average, participants were 18.9 years of age (*SD* = 3.0 years). The majority (84.6%) were in the first year of university.

Measures

Demographics Measure. Age, gender, and level of university education of the participants were collected with an author-compiled demographic questionnaire.

The Multidimensional Inventory of Hypochondriacal Traits (MIHT). The MIHT (Longley et al., 2005) was developed as a self-report measure of health anxiety. This 31-item scale is divided into four subscales designed to assess the core components of the hypochondriacal tendency: cognitive (seven items), perceptual (nine items), behavioral (eight items), and affective (seven items). The 31 individual items and the subscale to which each is intended to belong are indicated in Table 1. Each MIHT item is rated on a 5-point Likert-type scale (range 1–5). Thus, possible total MIHT scores range from 31 to 155. In the present study, we used both the total MIHT score and the four subscales (each calculated as subscale total scores). The original validation study showed the MIHT to possess good internal consistency (alphas > .80 for all subscales), test–retest reliability (subscale *r*s ranging from .75 to .78 over an 8-week interval), construct validity (structural or factorial validity consistent with theoretical four-factor structure), and concurrent validity (generally good convergent validity with the WI [Pilowsky, 1967], IAS [Kellner, 1987], HAQ [Lucock & Morely, 1996], and SSAS [Barsky et al., 1990] scales) in samples of both university students and general medical patients (Longley et al., 2005).

TABLE 1. Items, Factors, and Factor Loadings for the First-Order MIHT Model

Items and Factors	Factor Loadings I	II	III	IV
I. Cognitive factor: Alienation ($\alpha = .83$)				
31. Others do not seem sympathetic to my health problems.	.79			
8. I wish others took my health complaints more seriously.	.68			
2. I get upset about the way others respond to my illness.	.39			
27. Sometimes others do not seem very concerned about my health complaints.	.70			
10. The more I talk about my health problems, the less others seem to listen.	.65			
15. Few people seem to take my health concerns as seriously as I do.	.73			
4. People seem unconvinced my symptoms are signs of illness.	.57			
II. Behavioral factor: Reassurance ($\alpha = .82$)				
5. I turn to others for support when I do not feel well.		.56		
14. I like to be reassured when I feel sick.		.65		
26. If my symptoms worry me, I appreciate sympathy from others.		.70		
16. When I am hurt or ill, I like to have someone help me.		.66		
18. When I feel physical pain, I let others know.		.58		
20. It is important that others care about my health complaints.		.60		
1. When I was ill as a child, I liked to have my parents fuss over me.		.39		
25. Telling people about my health problems makes me feel better.		.70		
III. Perceptual factor: Absorption ($\alpha = .77$)				
3. I am aware of my body position.			.30	
30. I am usually aware of how I feel physically.			.63	
9. I am aware of physical sensation.			.33	
17. Even when I listen to a lecture or talk, I am alert to how my body feels.			.61	
19. I notice how clothes feel against my body.			.60	
13. When lying in bed at night, I am often aware of my body.			.57	
28. Generally, I am sensitive to changes in my body.			.56	
22. I keep close track of what is happening to me physically.			.51	
24. I am aware of how my body feels after a big meal.			.50	
IV. Affective factor: Worry ($\alpha = .80$)				
21. I worry a lot about my health.				.64
6. When I experience pain, I fear I may be ill.				.59
11. Reading articles about disease makes me worry about my health.				.72
7. If I notice a skin blemish, I worry it might lead to something serious.				.53

TABLE 1. (*Continued*)

Items and Factors	Factor Loadings I	II	III	IV
29. I am concerned with the possibility of being diagnosed with a serious disease.				.73
23. I worry about the physical problems of getting older.				.58
12. I try to avoid things that make me think of illness or death.				.47

Note. MIHT items are published in Longley et al. (2005, p. 7). Items here are presented in the same order as in Longley et al. (2005, p. 7) for ready comparison of results. Factor loadings are standardized. All factor loadings were significant at $p < .001$.

Anxiety Sensitivity Index (ASI). The 16-item ASI was used to assess participants' anxiety sensitivity levels (Peterson & Reiss, 1992). The ASI is a self-report measure assessing fear of anxiety sensations and beliefs that the sensations are potentially harmful. Each item is rated on a 5-point Likert-type scale (range 0–4) in terms of the respondent's degree of agreement/disagreement with the item. Possible ASI total scores range from 0 to 64. The ASI total score has been shown to possess excellent psychometric properties in a variety of clinical and nonclinical populations (Peterson & Reiss, 1992). Along with the overall total ASI score, three primary factors of the ASI (i.e., Physical, Cognitive, and Social Concerns) were also scored using the scoring system recommended by Zinbarg, Mohlman, and Hong (1999).[2] Sample items for each ASI scale are as follows: (a) for the eight-item Physical Concerns scale, "When I notice that my heart is beating rapidly, I worry that I might have a heart attack"; (b) for the four-item Cognitive Concerns scale, "When I cannot keep my mind on a task, I worry that I might be going crazy"; and (c) for the four-item Social Concerns scale, "It embarrasses me when my stomach growls."

Procedure

After students provided informed consent, they completed a survey containing the demographic measure described previously as well as a number of psychological inventories during class, including the MIHT and ASI described previously. These measures were used as screening instruments for identifying those eligible for other studies at Saint Francis Xavier University.

Results

Structural Equation Modeling

Structural equation modeling (SEM) analyses involved (a) confirmatory factor analyses and (b) convergent and discriminant validity analyses to address the first and second study purpose, respectively. SEM was performed using EQS 6.1 software (Bentler, 1995). Mardia's normalized estimate of multivariate kurtosis was significant in both SEM analyses (Mardia, 1970). This suggests that maximum likelihood (ML) estimation was not a suitable estimation technique since ML estimation assumes multivariate normality (Bentler & Wu, 1995; Kline, 2005). There is evidence suggesting that kurtosis, more so than skewness, is problematic when using ML estimation in SEM (Yuan, Lambert, & Fouladi, 2004). Failure to address kurtosis may result in inaccurate significance tests, chi-square values, and standard errors (DeCarlo, 1997). An examination of individual kurtoses revealed a wide range of values suggesting that heterogeneous kurtosis (HK) was present in the data for all SEM analyses. Thus, recommendations for analyzing data with HK (Bentler, Berkane, & Kano, 1991; MacIntosh, 1997) were followed, and the geometric mean approach to HK estimation was adopted.

As suggested by Byrne (2001) and others (e.g., Kline, 2005), model fit was evaluated with multiple indicators, including the χ^2/df ratio, comparative fit index (CFI), incremental fit index (IFI), standardized root mean square residual (SRMR), and root mean square error of approximation (RMSEA) with 90% confidence interval (90% CI). A χ^2/df in the range of 2, an SRMR in the range of .08, and an RMSEA in the range of .05 suggest adequate fit (Browne & Cudeck, 1993; Kline, 2005). For the CFI and the IFI, values in the range of .95 suggest a well-fitting model (Hu & Bentler, 1998).

Confirmatory Factor Analysis

Confirmatory factor analysis (CFA) was used to test the relation between latent variables and their constituent observed indicators. Two competing CFA models were also compared. The first-order model (Longley et al., 2005) holds that MIHT items are represented by four correlated first-order factors (i.e., Cognitive, Behavioral, Perceptual, and Affective). The second-order model holds that MIHT items are represented by four first-order factors that are, in turn, represented by one second-order factor representing the global hypochondriacal traits construct (see Figure 1). Both the first-order and the second-order model were well supported and showed acceptable fit indices (see Table 2). All factor loadings in the first-order model were significant and ranged from .30 to .79 (see Table 1). Moreover, as expected of separable but related domains, all latent correlations between the factors of the first-order model were significant but generally moderate (i.e., rs = .32–.65; see Table 3). As for the second-order model, all factor loadings for the MIHT items on the lower-order factors were significant, and all were > .30 (see Figure 1). Similarly, in the second-order model, all factor loadings for the lower-order dimensions onto the global hypochondriacal traits higher-order factor were significant and ranged from .49 (Perceptual) to .91 (Affective; see Figure 1). This latter pattern suggests that the global hypochondriacal traits construct receives a relatively large contribution from the affective domain (hypochondriacal worries and fears) and a relatively weaker but nonetheless significant contribution from the perceptual domain (somatic absorption).

Regarding model comparison, the Akaike information criterion (AIC) and the expected cross-validation index (ECVI) were similar for both models (Table 2). Smaller AIC values suggest better fit and greater parsimony, whereas smaller ECVI values suggest a greater likelihood of replication (Byrne, 2001). Thus, both models were well supported, and there was no strong evidence supporting the first-order model over the second-order model (or vice versa). The second-order model does, however, offer comparable fit with superior parsimony.

Convergent and Discriminant Validity Analyses

The hypochondriacal traits latent variable involved four observed indicators (i.e., the Cognitive, Behavioral, Perceptual, and Affective subscales of the MIHT), whereas the anxiety sensitivity latent variable involved three observed indicators (i.e., the Physical, Cognitive, and Social Concerns subscales of the ASI; see Figure 2). Observed variables served as salient and significant indicators of their respective latent variables, with factor loadings ranging from .38 (Perceptual) to .84 (Affective) for hypochondriacal traits and from .49 (Social Concerns) to .83 (Physical Concerns) for anxiety sensitivity (see Figure 2). A significant latent correlation of relatively large magnitude between hypochondriacal traits and anxiety sensitivity was also found, thus supporting the convergent validity of the MIHT (see Figure 2).

TABLE 2. Goodness-of-Fit Indices and Model Comparison Statistics

	Goodness-of-Fit Indices								Model Comparison Statistics			
Models	χ^2	*df*	χ^2/df	CFI	IFI	SRMR	RMSEA	RMSEA 90% CI	$\Delta\chi^2$	Δdf	AIC	ECVI
Confirmatory factor analyses of the MIHT												
First-order model	1,294.44	428	3.02	.95	.95	.06	.06	.06–.07	—	—	438.44	2.68
Second-order model	1,296.09	430	3.01	.95	.95	.06	.06	.06–.07	—[a]	—	436.09	2.67
Discriminant validity analyses: Hypochondriacal traits and anxiety sensitivity												
Single-construct model	152.89	14	10.92	.88	.88	.07	.14	.12–.16	—	—	124.89	.34
Dual-construct model	29.33	13	2.26	.99	.99	.03	.05	.03–.07	123.56[b]	1	3.33	.11

Note. CFI = comparative fit index; IFI = incremental fit index; SRMR = standardized root mean square residual; RMSEA = root mean square error of approximation; CI = confidence interval; AIC = Akaike information criterion; ECVI = expected cross-validation index. χ^2 values were $p < .01$.

[a]The first-order and the second-order models are not nested within one another. Thus, a χ^2 difference test was not possible. [b]The dual-construct model was a significant improvement over the single-construct model, $p < .001$.

TABLE 3. Latent Correlations Among the Four Latent Variables in the First-Order MIHT Model

Latent Variables	1	2	3
1. Cognitive	—		
2. Behavioral	.43	—	
3. Perceptual	.32	.37	—
4. Affective	.59	.65	.42

Note. All latent correlations are significant at $p < .001$.

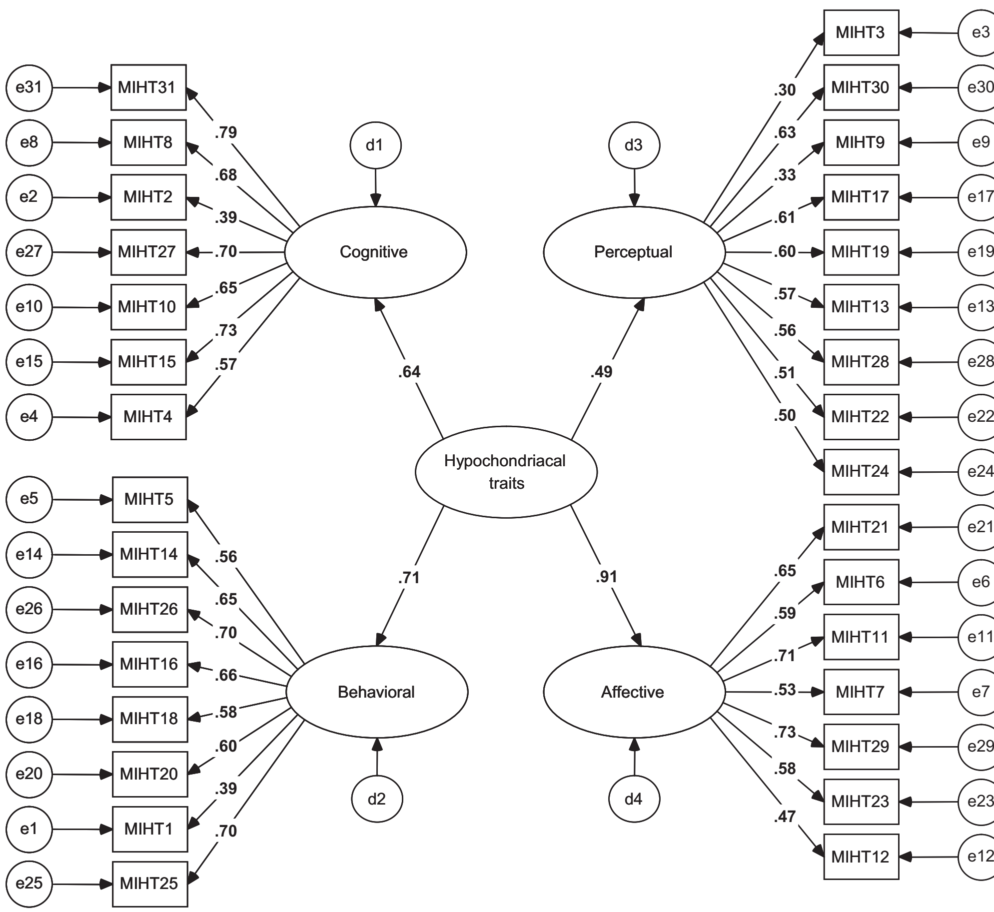

Figure 1. Illustration of the second-order MIHT model. Ovals represent latent variables; rectangles represent observed indicators. First-order factor loadings (e.g., .79) appear along single-headed arrows from latent variables (e.g., Cognitive) to observed indicators (e.g., MIHT1). Second-order factor loadings (e.g., .64) appear along single-headed arrows from the second-order latent variable (i.e., Hypochondriacal traits) to the first-order latent variables (e.g., Cognitive). Items are presented in the same order as in Longley et al. (2005, p. 7) for ready comparison of results. Factor loadings are standardized. All factor loadings were significant at $p < .001$.

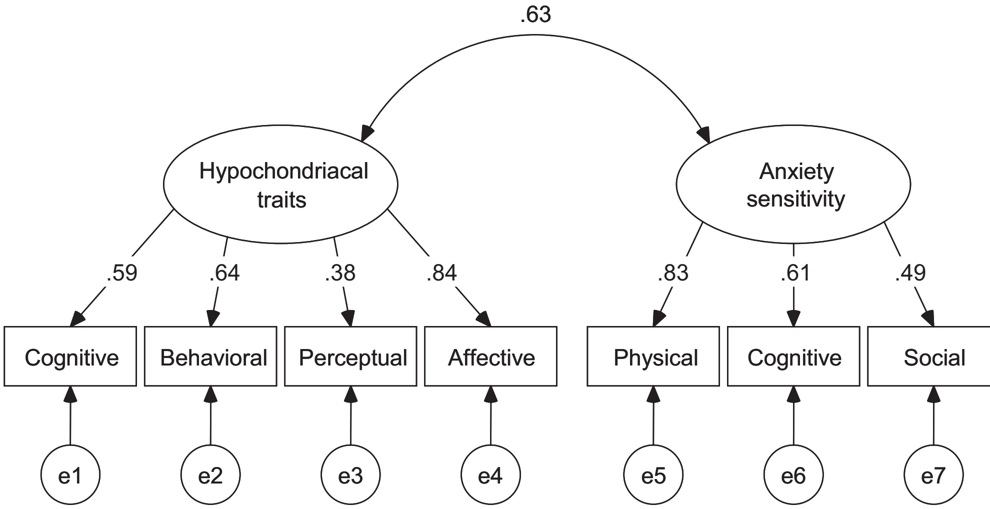

FIGURE 2. Illustration of the dual-construct model. Ovals represent latent variables; rectangles represent observed indicators. The latent correlation (i.e., .63) appears beside the double-headed arrow linking the hypochondriacal traits latent variable to the anxiety sensitivity latent variable. Factor loadings (e.g., .59) appear along single-headed arrows from latent variables (e.g., Hypochondriacal traits) to observed indicators (e.g., Cognitive). Factor loadings are standardized. The latent correlation and all factor loadings were significant at $p < .001$.

The discriminant validity of MIHT was also tested. Following Byrne (1998) and Kline (2005), the dual-construct model in Figure 2 was compared to a single-construct model wherein the latent correlation between hypochondriacal traits and anxiety sensitivity was fixed to equal 1.0. In the single-construct model, hypochondriacal traits and anxiety sensitivity were thus treated as identical. As seen in Table 2, the dual-construct model was favored over the single-construct model across a number of indices of fit and model comparison statistics. These results support the discriminant validity of MIHT by indicating that hypochondriacal traits and anxiety sensitivity are best understood as separate but highly correlated constructs, as suggested by Stewart and Watt (2000).

Bivariate Correlations

Bivariate correlations between ASI scales and MIHT scales are shown in Table 4.[3] Consistent with the third study hypothesis, ASI total scores were significantly and positively correlated with all four MIHT subscales as well as with the MIHT total score. The strongest correlation was between the ASI and the MIHT Affective subscale (large effect size). Moreover, all correlations between ASI subscales and MIHT scales were significant and tended to be moderate to large in magnitude. Consistent with the fourth study hypothesis, Physical Concerns was the ASI component most strongly correlated with each MIHT scale. The only exception was the Perceptual subscale of the MIHT, which appeared most strongly correlated with the ASI Social Concerns subscale. The pattern of results remained largely similar when these correlations were corrected for scale reliabilities using the formula provided by Cohen, Cohen, West, and Aiken (2003) (see disattenuated correlations in Table 4).[4]

Multiple Regression Analyses

Because the ASI scales are themselves significantly intercorrelated (Zinbarg et al., 1999), we also conducted a series of multiple regression analyses with each of the three ASI subscales as predictor variables and each of the MIHT scales serving, in turn, as criterion variables. In predicting MIHT

TABLE 4. Descriptive Statistics and Bivariate Correlations Between the MIHT and ASI Scales ($N = 535$)

	ASI Total	ASI Physical	ASI Cognitive	ASI Social	Mean	*SD*
MIHT Total	.47**	.46**	.34**	.25**	92.09	15.91
	(.55)	(.54)	(.44)	(.41)		
MIHT Cognitive	.31**	.28**	.24**	.21**	16.25	4.87
	(.38)	(.34)	(.32)	(.35)		
MIHT Perceptual	.25**	.21**	.17**	.22**	32.68	5.27
	(.32)	(.27)	(.23)	(.39)		
MIHT Behavioral	.34**	.37**	.25**	.10*	25.15	6.07
	(.42)	(.46)	(.33)	(.16)		
MIHT Affective	.45**	.45**	.33**	.22**	18.02	5.67
	(.55)	(.56)	(.44)	(0.38)		
Mean	19.27	9.19	2.95	7.13		
SD	8.63	5.54	2.67	2.48		

Note. *significant at $p < .05$; **significant at $p < .001$; disattenuated correlations appear in parentheses.

total scores, the block of ASI subscales explained 22.8% of the variance ($F[3, 531] = 52.25$, $p < .001$). At the univariate level, ASI Physical Concerns ($\beta = .37$, $p < .001$) and ASI Cognitive Concerns ($\beta = .14$, $p < .005$) were independent predictors. This same pattern of ASI subscale predictors was evident when MIHT Affective, Behavioral, and Cognitive scales served as criterion variables. In the case of the MIHT Affective subscale, the block of ASI subscales explained 21.5% of the variance ($F[3, 531] = 48.49$, $p < .001$) with ASI Physical Concerns ($\beta = .37$, $p < .001$) and ASI Cognitive Concerns ($\beta = .14$, $p < .005$) proving independent predictors. In the case of the MIHT Behavioral subscale, the block of ASI subscales explained 14.9% of the variance ($F[3, 531] = 31.02$, $p < .001$) with ASI Physical Concerns ($\beta = .36$, p $< .001$) and ASI Cognitive Concerns ($\beta = .10$, p $< .05$) proving independent predictors. In the case of the MIHT Cognitive subscale, the block of ASI subscales explained 9.8% of the variance ($F[3, 531] = 19.14$, $p < .001$) with ASI Physical Concerns ($\beta = .18$, $p < .001$) and ASI Cognitive Concerns ($\beta = .12$, $p < .05$) proving independent predictors.

In the case of the MIHT Perceptual subscale, the block of ASI subscales explained 6.9% of the variance ($F[3, 531] = 13.08$, $p < .001$). At the univariate level, a somewhat different pattern emerged relative to the other MIHT scales: ASI Social Concerns ($\beta = .15$, $p < .005$) and ASI Physical Concerns ($\beta = .12$, $p < .05$) proved significant independent predictors of this measure of somatic absorption. Together, these findings show that each of the ASI components is significantly related to some aspect of health anxiety, with ASI Physical Concerns proving the strongest and most consistent predictor, in line with our fourth study hypothesis.

Discussion

The present study provides considerable support for four distinct factors in the MIHT: (a) an affective component involving fears of and worries about illness and disease, (b) a cognitive component involving disease conviction that is not taken as seriously by others, (c) a behavioral component involving reassurance seeking, and (d) a perceptual component involving somatic absorption. Our CFA results show that these factors can be usefully interpreted in and of themselves, but they may also be interpreted hierarchically with the four lower-order factors being considered aspects of the higher-order factor of global health anxiety. There were no substantive differences between the first-order and second-order factor models, and both showed good to excellent fit to the MIHT data. Both also have their unique advantages. The lower-order model replicates earlier results obtained by Longley et al. (2005) in the original validation study. And, like Longley et al. (2005), we found the lower-order MIHT dimensions to possess adequate to good internal consistency (all alphas > .70; Nunnally, 1978). However, the present study represents the first test of an alternate conceptualization of the MIHT as a hierarchical measure. The CFA results supported the second-order model as a viable alternative structure for this measure. Specifically, the second-order model offered comparable fit relative to the first-order model but with superior parsimony. The magnitude of the loadings of the lower-order dimensions onto the higher-order dimension suggests that the affective feature of fears and worries about illness contributes most strongly to the global health anxiety construct, whereas the perceptual feature of somatic absorption provides a relatively weaker but nonetheless significant contribution. Clinically, the latter model fits with common case conceptualizations of health-anxious patients (e.g., see cases presented by Stewart & Watt, 2001). Statistical support for the hierarchical model suggests that it is appropriate to calculate both a total MIHT score representing the global health anxiety construct and/or four subscale scores representing the more specific lower-order domains, depending on the purposes of the assessment.

As hypothesized, we found a significant bivariate correlation between total scores on the ASI and total scores on the MIHT. In two additional analyses (i.e., a disattenuated correlation and a latent correlation), we showed that the magnitude of this relationship increased when measurement error was controlled. The magnitude of the relationship between anxiety sensitivity and the global health anxiety construct observed in the present study is consistent with that reported in studies using the IAS (Bravo & Silverman, 2001; Frazier & Wade, 1999; Otto et al., 1992, 1998; Stewart & Watt, 2000). The moderate correlation suggests that the two are overlapping yet not redundant constructs. Indeed, SEM analyses revealed a significant improvement in fit when anxiety sensitivity and health anxiety were modeled as two intercorrelated yet distinct constructs (see Figure 2) relative to a model where both were considered manifestations of a common underlying trait. In fact, only the dual-construct (and not the single-construct) model provided a suitable fit to the data.

Considering relationships of anxiety sensitivity to specific health anxiety dimensions, consistent with prior findings obtained with the IAS (Stewart & Watt, 2000), anxiety sensitivity was significantly correlated both with the affective and cognitive dimensions of health anxiety on the MIHT. As with the previous study with the IAS (Stewart & Watt, 2000), the strongest bivariate relation was between the ASI and the affective dimension of hypochondriacal traits. The observed correlation between the ASI and the cognitive dimension of the MIHT ($r = .31$), although statistically significant, was lower than that reported by Stewart and Watt (2000), who found that the ASI and the IAS cognitive dimension were correlated at $r = .50$ (a significant difference between correlation coefficients: $Z = 2.73$, $p < .01$; Preacher, 2002). At first glance, this appears surprising given the status of anxiety sensitivity as a cognitive individual difference variable involving the catastrophic misinterpretation of arousal-related bodily sensations (Taylor, 1999)—a variable that might seem most closely aligned with the cognitive feature of health anxiety. However, a closer look at the content of the cognitive dimensions on the MIHT versus the IAS reveals that the two measures conceptualize this dimension somewhat differently. On the IAS, the cognitive dimension largely involves hypochondriacal beliefs or disease conviction (e.g., IAS item 10: "Do you believe that you have a physical disease, but the doctors have not diagnosed it correctly?"; see Stewart & Watt, 2000, p. 89), whereas on the MIHT this dimension is more of a social-cognitive characteristic involving "alienation" or the tendency to perceive others as unsupportive of the respondent's illness concerns and disease conviction (e.g., "Others do not seem sympathetic to my health problems"). The latter conceptualization is consistent with the interpersonal model of health anxiety (e.g., Noyes et al., 2003), whereas the former is more consistent with a cognitive-behavioral conceptualization (e.g., Warwick & Salkovskis, 1990). This result is interesting nonetheless as it extends prior work on the relations of anxiety sensitivity to health anxiety dimensions (Watt & Stewart, 2000) by showing that anxiety sensitivity is also related to a social-cognitive dimension of health anxiety as outlined in the interpersonal model of hypochondriasis. This suggests that anxiety-sensitive people are likely to perceive others as unsupportive of their health complaints. This experience of alienation (Noyes et al., 2003) could lead anxiety-sensitive individuals to turn their focus inward toward their bodily symptoms since ego-relevant failure experiences have been shown to lead to increases in self-awareness (e.g., Greenberg & Pyszczynski, 1986).

Consistent with our hypothesis but contrary to previous study findings (Stewart & Watt, 2000), ASI scores were also significantly correlated with the behavioral component of health anxiety (i.e., with MIHT Behavioral subscale scores). Taken together, these results suggest that although anxiety sensitivity may not be associated with healthy lifestyle choices (such as avoidance of unhealthy foods), it is significantly positively associated with the more typical health anxiety–related behavior of reassurance seeking. Future research should examine the degree to which anxiety sensitivity is related to other behaviors commonly seen in patients with elevated health anxiety and those with hypochondriasis, namely, bodily checking and avoidance behaviors (Stewart & Watt, 2001).

Finally, the use of the MIHT in the present study allowed us to examine relations of anxiety sensitivity with the perceptual anomaly characteristic of those with hypochondriasis (i.e., somatic absorption). The present findings suggest that, as hypothesized, anxiety sensitivity is significantly positively related to increased preoccupation with bodily symptoms (i.e., with MIHT Perceptual subscale scores); this relationship was moderate in magnitude, suggesting that somatic absorption and anxiety sensitivity are not redundant constructs. This observed relationship is consistent with the literature linking anxiety sensitivity to increased interoceptive acuity (e.g., Stewart, Buffett-Jerrott, & Kokaram, 2001). It would be interesting for future work to use interoceptive acuity tasks with individuals who score high on the MIHT Perceptual scale. This would seem particularly important given the results of a recent review suggesting that there is little evidence that individuals high in health anxiety (as assessed with measures other than the MIHT) are actually more accurate perceivers of their own autonomic processes (Marcus, Gurley, Marchi, & Bauer, 2007).

When we examined the relations of the lower-order ASI dimensions (Physical, Cognitive, and Social Concerns) with the various dimensions of health anxiety on the MIHT, we found results largely consistent with hypotheses. Specifically, it was the ASI Physical Concerns scale that was the strongest and most consistent predictor of the various aspects of health anxiety. In multiple regression analyses, ASI Cognitive Concerns also proved a significant independent predictor over and above ASI Physical Concerns in all but one case. This pattern is consistent with the ASI predictors of panic disorder phenomenology (e.g., McLaughlin, Stewart, & Taylor, 2007; Zvolensky, Feldner, Eifert, & Stewart, 2001) and suggests that ASI Physical Concerns and, to a lesser extent, ASI Cognitive Concerns may be common underlying factors in helping explain the high comorbidity of panic disorder and hypochondriasis (Barsky, Barnett, & Cleary, 1994). The one exception to this pattern was in the case of the MIHT Perceptual scale, where ASI Social Concerns proved the strongest predictor. Given the heightened levels of ASI Social Concerns among those with social phobia (McLaughlin et al., in press; Zinbarg, Barlow, & Brown, 1997) and the evidence for elevated self-focused attention among those with social phobia (see review by Bögels & Mansell, 2004), the present results suggest that somatic absorption is one way in which self-focused attention may manifest among individuals with high ASI Social Concerns.

Several potential limitations of the present study that provide important directions for future research should be acknowledged. First, we did not include or control for alternative anxiety-related constructs that might contribute to the relations of anxiety sensitivity with health anxiety. Nonetheless, Stewart and Watt (2000) showed that anxiety sensitivity was related to hypochondriacal concerns even after accounting for levels of trait anxiety and panic, at least when hypochondriacal concerns were assessed with the IAS (Kellner, 1987). Second, to assess anxiety sensitivity dimensions, we used the 16-item ASI (Reiss et al., 1986), which has been criticized for containing too few items to reliably tap the ASI Cognitive and Social Concerns dimensions (e.g., Taylor & Cox, 1998). Nonetheless, calculation of disattenuated correlations showed that the ASI Physical Concerns scale remained most strongly correlated with the majority of health anxiety dimensions after accounting for scale reliabilities. In addition, the fact that ASI Social Concerns proved the strongest predictor of the MIHT Perceptual scale demonstrates that the shorter ASI Social Concerns subscale is capable of associating at least as strongly with a criterion variable as the longer and more reliable ASI Physical Concerns subscale (Zinbarg, Brown, Barlow, & Rapee, 2001). Third, the present study was conducted with a nonclinical sample of undergraduates, and thus the results may not generalize well to clinical samples. In future research, it will be important to collect normative data on the MIHT subscales and to examine relations of the MIHT to anxiety sensitivity among patients with hypochondriasis as well as in patients with medical conditions or other psychological disorders who also may exhibit elevated health anxiety (e.g., panic disorder or somatization disorder). Finally, while the present study adds to the literature on the good psychometric properties of the MIHT as a novel measure of the core dimensions of health anxiety (Longley et al., 2005), it remains to be determined whether the scale possesses treatment sensitivity. Future clinical trials investigating the efficacy of cognitive-behavioral approaches to the treatment of hypochondriasis (e.g., Barsky & Ahern, 2004) should incorporate the MIHT as a potential treatment outcome evaluation tool.

A final interpretive caveat pertains to limitations of the MIHT itself. Some of the MIHT scales—the Cognitive and Behavioral scales in particular—assess specific facets of the cognitive and behavioral domains of the health anxiety construct. In fact, they focus on the very facets of these domains emphasized in the interpersonal model of hypochondriasis—namely, beliefs about others being unsupportive (i.e., alienation) and reassurance-seeking behaviors (Noyes et al., 2003). Thus, these two MIHT scales fail to cover other important types of cognitions and behaviors emphasized within cognitive-behavioral models of health anxiety, including catastrophic misinterpretation of somatic cues, bodily checking, and avoidance of health threat information (e.g., Abramowitz et al., 2002; Taylor & Asmundson, 2004; Warwick & Salkovskis, 1990; Williams, 2004). Of course, this point does not negate the clinical utility of this new measure. However, it does suggest that the MIHT should not be considered a "stand-alone" self-report instrument that covers all relevant aspects of health anxiety. For example, the usefulness of the MIHT in case conceptualization is limited by the fact that it fails to cover certain important domains that would need to be assessed via other means for a complete clinical picture.

Although further research is required, the present study has several important implications for the practice of cognitive psychotherapy. First, it provides additional data supporting the strong psychometric properties of a new self-report instrument designed to tap the four main components of the hypochondriacal tendency. This newer tool may prove useful in assessment in clinical practice for case conceptualization, treatment planning, and tracking progress in therapy since the MIHT is the only existing scale that adequately captures at least some facets of all core dimensions of health anxiety. Second, the study provides additional data highlighting the link between the cognitive individual difference variable of anxiety sensitivity and various aspects of health anxiety. Consistent with previous data, anxiety sensitivity was associated with health-anxious affect. The findings also provide new data linking elevated anxiety sensitivity with reassurance seeking, cognitive alienation, and somatic absorption. These findings (although correlational) are consistent with suggestions that anxiety sensitivity might be a useful additional target in cognitive treatments of hypochondriasis since it appears to contribute to each of the core aspects of hypochondriasis. Recent literature shows that interoceptive exposure is an important treatment component in reducing elevated anxiety sensitivity (e.g., Wald & Taylor, 2005; Watt, Stewart, Lefaivre, & Uman, 2006). Given that ASI Physical Concerns was the only ASI subscale that was consistently related to all health anxiety dimensions in the present study, a focus on this aspect of anxiety sensitivity seems most appropriate in cognitive-behavioral approaches to the treatment of hypochondriasis and other conditions involving elevated health anxiety.

Notes

1. From the continuum perspective, some refer to levels of *hypochondriacal concerns* or *hypochondriacal traits.* Here, we use these two terms interchangeably, with the term *health anxiety* when referring to the continuum perspective and the term *hypochondriasis* when referring to the categorical, diagnostic perspective.

2. Specifically, as recommended by Zinbarg et al. (1999), the ASI Physical Concerns subscale was calculated as the total of items 3, 4, 6, 8, 9, 10, 11, and 14; the ASI Cognitive Concerns subscale was calculated as the total of items 2, 12, 15, and 16; and the ASI Social Concerns subscale was calculated as the total of items 1, 5, 7, and 13.

3. Correlation coefficients were interpreted in line with recommendations by Cohen (1992). Values in the range of .10 were taken to signify small effect sizes, values in the range of .30 to signify medium effect sizes, and values in the range of .50 to signify large effect sizes (Cohen, 1992).

4. It is important to examine disattenuated correlations in the case of correlations with the ASI subscales since two scales (i.e., the ASI Cognitive Concerns and Social Concerns subscales) have been shown to possess less-than-desirable internal consistencies (see Taylor & Cox, 1998), likely because of their small numbers of items (four items each; see Nunnally, 1978).

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