

# Is Hypochondriasis Related to Obsessive-Compulsive Disorder, Panic Disorder, or Both? An Empirical Evaluation

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Although hypochondriasis (HC) is considered a somatoform disorder in the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text revision), some authors have pointed out that the symptoms of HC overlap with certain anxiety disorders, namely, panic disorder (PD) and obsessive-compulsive disorder (OCD). Few studies have empirically addressed this overlap. In the present investigation, we used discriminant function analysis to explore how patients with a principal diagnosis of HC, OCD, or PD varied with respect to cardinal symptoms of these disorders (i.e., health anxiety, obsessions and compulsions, and panic-related anxiety and avoidance) and key cognitive biases (i.e., intolerance of uncertainty, anxiety sensitivity, and body vigilance). Fifty treatment-seeking individuals with PD, 21 with OCD, and 23 with HC completed self-report measures of symptoms and cognitions during their clinic visit. Results indicated that whereas individuals with HC experience panic attacks, obsessions, and compulsions, these symptoms are markedly less pronounced than among those with PD and OCD. Conversely, overlaps were found in terms of cognitive biases, with HC patients demonstrating elevated levels of intolerance of uncertainty, body vigilance, and fear of cardiovascular symptoms. Implications for the conceptualization and treatment of HC are discussed.

**Keywords:** hypochondriasis; health anxiety; obsessive-compulsive disorder; panic disorder; cognitive bias

According to the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text revision; *DSM-IV-TR*; American Psychiatric Association [APA], 2000), hypochondriasis (HC) is a somatoform disorder characterized by a preoccupation with the (inaccurate) belief that one has or is in danger of developing a serious medical illness. The preoccupation is usually based on the misinterpretation of benign bodily sensations as symptoms of a disease (e.g., headache = brain tumor). In many instances, HC disrupts social, occupational, and family functioning. Moreover, it persists despite appropriate medical evaluation and reassurance of good health. In fact, a cardinal feature of HC is the repeated seeking of unwarranted medical examinations, engaging in frequent checks of one's own body, and the excessive collection

information about medical illnesses from sources such as the Internet. Individuals with HC are often preoccupied with establishing the origin and authenticity of their somatic complaints.

Although HC is considered a somatoform disorder because of patients' focus on bodily symptoms, authors have recently pointed out that the symptoms of HC overlap remarkably with some anxiety disorders, most notably panic disorder (PD) and obsessive-compulsive disorder (OCD; e.g., Noyes, 1999). For instance, as in HC, patients with PD evidence a focus on somatic cues (Schmidt, Lerew, & Trakowski, 1997). The cardinal feature of PD, panic attacks, involves unexpected and repeated episodes of intense fear accompanied by physical symptoms such as heart palpitations, chest pain, shortness of breath, dizziness, tingling sensations, and abdominal distress (APA, 2000). Although no actual threat exists (i.e., the physical symptoms are simply those that commonly accompany anxious arousal), people with PD often attribute panic episodes to organic causes such as a heart attacks, strokes, and other serious medical conditions (Barlow, 2002). Accordingly, like those with HC, patients with PD often seek extensive medical examinations and consult numerous specialists (e.g., cardiologists) in hopes of finding the organic cause of their physical symptoms (Deacon, Lickel, & Abramowitz, 2008).

The central features of OCD include recurrent intrusive unacceptable thoughts, ideas, or images (obsessions) that evoke anxiety and efforts to resist or neutralize anxiety by ritualistically engaging in some other thought or action (compulsive rituals; APA, 2000). The themes of obsessions and compulsions vary widely (e.g., McKay et al., 2004) but often include recurrent obsessional thoughts about illness resulting from contamination and repetitive (compulsive) washing and cleaning rituals. Some authors have concluded that simply the presence of repetitive thinking and behavior in both OCD and HC denotes a relationship between the two conditions (e.g., Hollander, Friedberg, Wasserman, Yeh, & Iyengar, 2005). Others (e.g., Fallon, Javitch, Hollander, & Liebowitz, 1991) have drawn attention to apparent similarity in *content* of the repetitive thinking and behaviors in HC and OCD, namely, obsessive thoughts about illness and compulsive checking and reassurance-seeking behavior.

Seeming similarities among disorders discussed here arise from somewhat superficial overlaps in symptom complaints. The fact that both HC and PD involve a focus on somatic complaints and illness conviction demonstrates this approach to conceptualizing two (or more) psychological disorders as similar or even *related*. Another example of this approach is the assumption of similarities based on the fact that repetitive thinking and behavior are present in both HC and OCD. The question remains, however, whether similar psychological processes underlie these apparently similar superficial symptoms. Indeed, as we have pointed out elsewhere (Abramowitz & Deacon, 2005), different types of repetitive behaviors can arise from (and be maintained by) different cognitive and behavioral mechanisms. Thus, in light of prevailing cognitive theoretical models of anxiety (e.g., Beck & Emery, 1985), a more compelling approach to understanding the degree to which the symptoms of HC overlap with PD and OCD would be to compare key cognitive processes that might mediate the symptoms mentioned previously.

Candidates for overlapping cognitive mediators of somatic focus and illness conviction in HC and PD include (a) the tendency to misinterpret harmless bodily sensations as physically harmful (i.e., anxiety sensitivity [AS]) and (b) the tendency to attend to and closely monitor internal sensations (i.e., body vigilance). Several studies indicate that AS is present in both HC and PD (e.g., Cox, Borger, & Enns, 1999) and that it is associated with HC and PD symptoms in various clinical and nonclinical populations (e.g., Abramowitz, Deacon, & Valentiner, 2007; Bravo & Silverman, 2001; Deacon & Abramowitz, 2006; MacDonald, Baker, Stewart, & Skinner, 2000; Otto, Demopolos, McLean, Pollack, & Fava, 1998; Otto, Pollack, Sachs, & Rosenbaum, 1992; Stewart & Watt, 2000). Whereas there has been less work on body vigilance, preliminary evidence suggests that this phenomenon is also present in both HC and PD (Olatunji, Deacon, Abramowitz, & Valentiner, 2007).

Compulsive checking is thought to result from the need to resolve doubt and thereby attain certainty (Rachman, 2002). Accordingly, intolerance of uncertainty might be an overlapping cognitive

feature of HC and OCD. To date, no studies have compared individuals with HC and those with OCD on this variable. In fact, there are no existing clinical studies on the relationship between intolerance of uncertainty and HC symptoms, though one investigation found a significant, positive correlation between health anxiety and the intolerance of uncertainty (Abramowitz, Deacon, & Valentiner, 2007). Research with OCD patients, however, indicates that checking symptoms are associated with intolerance of uncertainty (e.g., Deacon, Abramowitz, & Maack, 2008; Tolin, Abramowitz, Brigidi, & Foa, 2003). One aim of the present study was therefore to investigate further whether HC, PD, and OCD overlap in terms of the cognitive variables discussed previously.

Contemporary models of HC view this problem as a form of intense health anxiety (e.g., Taylor & Asmundson, 2004). Some authors (e.g., Noyes, 1999) have drawn attention to similarities between HC and certain anxiety disorders, raising the question of whether HC should be included within the anxiety disorders in future editions of the *DSM* (i.e., *DSM-V*). Yet before such changes are made, we think it is important to extensively evaluate apparent overlaps between HC and established anxiety disorders at both superficial and more fundamental levels. Relative to PD and OCD, which have well-established and empirically supported cognitive-behavioral conceptual and treatment approaches, advances in understanding and treating HC are at earlier stages. If HC involves similar cognitive processes as PD and OCD, cognitive-behavioral therapy procedures applied with these disorders might also be adapted for use with HC. For example, Wilhelm and Steketee (2006) describe the use of several cognitive therapy strategies for challenging and modifying the intolerance of uncertainty in patients with OCD. At present, such techniques are not generally applied in the treatment of HC but would be indicated if this cognitive process is found to be present.

As reviewed here, previous empirical work has provided partial evidence for overlaps in symptoms and cognitive processes among HC, PD, and OCD. Most of this evidence comes from comparisons across correlational studies of HC, PD, or OCD samples. A few controlled studies have directly compared these disorders on one or more potentially overlapping variables (e.g., Otto et al., 1998; Olatunji et al., 2007). Whereas these approaches are informative, it would be further instructive to establish a symptom-based or cognitive *profile* for these disorders that could be used to determine the similarities and differences between HC on the one hand and PD and OCD on the other. Therefore, in the present study we sought not only to compare groups of patients with HC, PD, and OCD on a variety of symptom and cognitive measures relevant to these disorders but also to use these measures to empirically establish a symptom and cognitive profile to predict each patient's diagnosis and characterize how the three diagnostic groups differ with respect to patterns of these symptoms and cognitions. Specifically, using discriminant function analysis, we explored how patients with a principal diagnosis of HC, OCD, or PD varied with respect to their levels of health anxiety, OC symptoms, panic symptoms, intolerance of uncertainty, anxiety sensitivity, and body vigilance. We hypothesized the following: (a) relative to PD and OCD, HC would be associated with higher levels of health anxiety and fewer panic and OC symptoms, respectively; (b) HC would appear similar to PD with respect to elevated levels of anxiety sensitivity and body vigilance; and (c) HC would appear similar to OCD with respect to elevated levels of intolerance of uncertainty.

## METHOD

### Participants

Data were collected from 106 treatment-seeking adults with a principal diagnosis of PD, OCD, or HC. To reduce overlap between diagnostic groups, we excluded eight PD patients with additional diagnoses of HC ( $n = 6$ ) and OCD ( $n = 2$ ) and two OCD patients with an additional diagnosis of HC. No HC patients had additional diagnoses of PD or OCD. The final sample consisted of

94 patients: 50 with PD with ( $n = 26$ ) or without ( $n = 24$ ) agoraphobia, 21 with OCD, and 23 with HC. Additional axis I diagnoses were assigned to 45 individuals (47.9%), the most common of which were major depressive disorder ( $n = 20$ ), generalized anxiety disorder ( $n = 15$ ), and specific phobia ( $n = 5$ ). The frequency of additional diagnoses did not differ between the diagnostic groups,  $\chi^2(2) = 2.07, p > .10$ . The mean age of the sample was 37.4 ( $SD = 13.7$ ), and over half the patients (63.8%) were women. The sample was mainly White (83.0%). Nearly all participants had earned a high school diploma (97.8%), and many had at least a 2-year college degree (52.1%). About half the sample was married (59.6%).

## Measures

**Short Health Anxiety Inventory.** The Short Health Anxiety Inventory (SHAI; Salkovskis, Rimes, Warrick, & Clark, 2002) contains 18 items that assess health anxiety and other symptoms of HC independently of physical health status. Items assess worry about health, awareness of bodily sensations or changes, and feared consequences of having an illness. The SHAI has demonstrated good reliability and validity in clinical and nonclinical samples (Abramowitz et al., 2007; Salkovskis et al., 2002). Internal consistency in the present study was excellent ( $\alpha = .95$ ).

**Panic and Agoraphobia Scale.** The Panic and Agoraphobia Scale (PAS; Bandelow, 1995) is a 13-item measure of PD symptoms that is available in an observer-rated version and the self-report version used in the present study. Items assess panic attacks, agoraphobic avoidance, anticipatory anxiety, disability and functional impairment, and health concerns. The self-report version of the PAS possesses good internal consistency, treatment sensitivity, and concurrent validity with other measures of panic (Bandelow, 1999; Bandelow et al., 1998). The PAS's internal consistency in the present study was  $\alpha = .92$ .

**Obsessive-Compulsive Inventory–Revised.** The Obsessive-Compulsive Inventory–Revised (OCI-R; Foa et al., 2002) is an 18-item self-report measure of OCD symptoms that is based on the earlier 84-item Obsessive-Compulsive Inventory (Foa, Kozak, Salkovskis, Coles, & Amir, 1998). Respondents rate the degree to which they have been bothered or distressed by 18 common symptoms of OCD in the past month. The OCI-R assesses six symptom domains: (a) washing, (b) checking/doubting, (c) obsessing, (d) mental neutralizing, (e) ordering, and (f) hoarding. OCI-R total scores have demonstrated excellent psychometric properties and validity (Foa et al., 2002). The OCI-R demonstrated adequate internal consistency ( $\alpha = .90$ ) in this study.

**Anxiety Sensitivity Index–Revised.** The Anxiety Sensitivity Index–Revised (ASI-R; Taylor & Cox, 1998) is a 36-item, expanded version of the original ASI (Reiss, Peterson, Gursky, & McNally, 1986) and measures the fear of anxiety-related sensations based on beliefs about their harmful consequences. The ASI-R has demonstrated excellent internal consistency and adequate validity in clinical samples studies (Deacon & Abramowitz, 2006; Taylor & Cox, 1998). The ASI-R contains four subscales: (a) fear of respiratory symptoms, (b) fear of cardiovascular symptoms, (c) fear of publicly observable anxiety reactions, and (d) fear of cognitive dyscontrol. The former two subscales assess the cognitive processes of primary interest in the present study, while the latter two assess aspects of anxiety sensitivity that have not been proposed as relevant to the understanding of HC. Moreover, Deacon and Abramowitz (2006) found that the fear of respiratory and cardiovascular symptoms subscales were more strongly correlated with scores on the PAS, OCI-R, and SHAI than the other two ASI-R subscales. Accordingly, we elected to use only the fear of respiratory and fear of cardiovascular symptoms subscales in the present study. The fear of respiratory concerns subscale consists of 12 items (range = 0–48), while the fear of cardiovascular concerns subscale has 11 items (range = 0–44). Internal consistency coefficients for these subscales in the current study were .85 and .92, respectively.

**Body Vigilance Scale.** The Body Vigilance Scale (BVS; Schmidt et al., 1997) measures the tendency to attend to panic-related body sensations. The measure consists of four items. Three

items assess the degree of attentional focus, perceived sensitivity to changes in bodily sensations, and the average amount of time spent attending to bodily sensations. The fourth item measures the extent to which the respondent reports attending to 15 panic-related bodily sensations (e.g., heart palpitations) that include all the DSM-IV physical symptoms of panic attacks (American Psychiatric Association, 1994). The BVS has demonstrated good internal consistency and adequate test-retest reliability (Olatunji et al., 2007; Schmidt et al., 1997). Internal consistency in the present study was adequate ( $\alpha = .87$ ).

**Intolerance of Uncertainty Scale.** The Intolerance of Uncertainty Scale (IUS; Freeston, Rhéaume, Letarte, Dugas, & Ladoceur, 1994) is a 27-item self-report measure of an individual's intolerance of uncertainty, particularly the ideas that uncertainty is unacceptable, reflects badly on a person, leads to frustration and stress, and leads to the inability to take action. Sample items include "Uncertainty makes life intolerable" and "I always want to know what the future has in store for me." Each item is rated on a 5-point Likert-type scale, and total scores range from 27 to 135. The scale has adequate psychometric properties and acceptable construct validity (Freeston et al., 1994) and demonstrated excellent internal consistency in the present study ( $\alpha = .95$ ).

## Procedure

Prior to their evaluation, patients completed a packet of self-report questionnaires that contained the study measures. Evaluation took place in a multidisciplinary anxiety disorders clinic within a large academic medical center and included a 1.5-hour interview performed by a psychologist who conducted a functional assessment of the patient's anxiety symptoms and administered the anxiety and mood disorders sections of the Mini International Neuropsychiatric Interview (Sheehan et al., 1998) to establish DSM-IV diagnoses. The assessment also included a 1-hour diagnostic interview conducted by a psychiatrist who examined the patient's medical and pharmacological history. All assessors met together with the second author to discuss diagnostic impressions and case conceptualization and to formulate a treatment plan for each patient. Patients were then presented with this information in a case conference format with all assessors and the second author present. Although interrater reliability for the primary diagnosis was not formally examined, patients were included in the present study only if there was 100% inter-rater agreement (first interviewer, second interviewer, second author) on the patient's principal diagnosis.

## RESULTS

### Preliminary Analyses

Prior to conducting group comparisons on the variables of interest, we examined whether diagnostic group membership was confounded with demographic characteristics. The PD, OCD, and HC groups did not differ significantly with respect to age,  $F(2, 85) = 0.54, p > .10$ , gender,  $\chi^2(2) = 2.21, p > .10$ , or education,  $F(2, 90) = 1.23, p > .10$ . Accordingly, we did not control for these variables in subsequent analyses.

### Group Comparisons: Symptom Measures

Table 1 presents the group mean scores for each of the symptom measures. A series of one-way analyses of variance (ANOVAs) was conducted to examine differences in PD symptoms, OCD symptoms, and HC symptoms between patients with a principal diagnosis of PD, OCD, or HC. The results of these tests (also presented in Table 1) indicated significant between-group differences for symptoms of HC (SHAI), PD (PAS), and OCD (OCI-R) in the predicted direction. Post hoc Fisher's Least Significant Difference (LSD) tests indicated that OCI-R scores

were significantly higher among OCD patients than among those with PD ( $p < .001$ ) and HC ( $p < .001$ ), while PD and HC patients did not significantly differ from each other ( $p > .05$ ). Likewise, HC patients had significantly higher SHAI scores than did those with PD ( $p < .001$ ) and OCD ( $p < .001$ ), who did not differ from each other ( $p > .05$ ). Lastly, PD patients had significantly higher PAS scores than did HC patients ( $p < .001$ ). OCD patients exhibited elevated PAS scores relative to HC patients ( $p < .05$ ) and had scores that were lower than but not statistically different from those of PD patients ( $p = .12$ ).

A discriminant function analysis was conducted to examine how well the SHAI, PAS, and OCI-R discriminated between the diagnostic groups. The prior probabilities of group membership were .25 for HC, .62 for PD, and .13 for OCD, respectively, reflecting the random probability of classifying individuals correctly. For the discriminant analysis to be significant, the canonical discriminant functions, which reflect the linear combinations of the predictor variables that maximize the difference between diagnostic groups, must correctly classify individuals better than these chance probabilities. The discriminant analyses and subsequent classification analyses are based on quadratic assignment using the pooled within-groups covariance matrix and were computed from group sizes because of the unequal proportion of individuals in each diagnostic group. Because of missing data, sample sizes for this analysis were 49 for PD, 20 for HC, and 10 for OCD.

Of the two possible discriminant functions, both were statistically significant. The first function accounted for 60.9% of the between-groups variability and had a canonical correlation of .67, Wilks'  $\lambda = .36$ ,  $\chi^2(6) = 77.56$ ,  $p < .001$ . The second function accounted for 39.1% of the variance and had a canonical correlation of .59, Wilks'  $\lambda = .65$ ,  $\chi^2(2) = 32.15$ ,  $p < .001$ . Together, the two functions correctly classified 89.8% of PD patients, 75.0% of HC patients, and 30.0% of

**TABLE 1. GROUP MEANS (STANDARD DEVIATIONS) AND UNIVARIATE TESTS FOR THE STUDY MEASURES**

Measure	Patient Group			<i>F</i>	<i>df</i> <sup>a</sup>
	Panic Disorder	OCD	HC		
Disorder-specific symptom measures					
SHAI	19.08 (10.32)	15.43 (12.87)	31.22 (9.30)	14.09****	2, 91
PAS	24.52 (10.81)	18.64 (15.57)	9.45 (8.61)	13.32****	2, 78
OCI-R	11.67 (9.37)	28.00 (12.77)	10.39 (6.87)	23.50****	2, 89
Cognitive measures					
BVS	24.95 (8.14)	18.44 (10.17)	22.81 (9.17)	3.68**	2, 86
IUS	57.25 (20.92)	70.81 (19.23)	74.05 (22.32)	4.12**	2, 56
ASI-R Respiratory	26.54 (14.55)	21.05 (12.25)	19.83 (9.58)	2.65*	2, 91
ASI-R Cardiovascular	15.24 (10.71)	11.05 (11.27)	22.56 (12.42)	6.04***	2, 91

*Note.* SHAI = Short Health Anxiety Inventory; PAS = Panic and Agoraphobia Scale; OCI-R = Obsessive-Compulsive Inventory–Revised; BVS = Body Vigilance Scale; IUS = Intolerance of Uncertainty Scale; ASI-R Respiratory = Fear of Respiratory Concerns subscale of the Anxiety Sensitivity Index–Revised; ASI-R Cardiovascular = Fear of Cardiovascular Concerns subscale of the Anxiety Sensitivity Index–Revised.

<sup>a</sup>Because of missing data, PAS scores were unavailable for 10 patients with OCD and IUS scores were unavailable for 22 PD patients and 10 OCD patients.

\* $p < .10$ . \*\* $p < .05$ . \*\*\* $p < .01$ . \*\*\*\* $p < .001$ .

**TABLE 2. CORRELATIONS BETWEEN DISORDER-SPECIFIC SYMPTOM MEASURES AND THE DISCRIMINANT FUNCTIONS**

Predictor	Function 1	Function 2
PAS	.63	.06
OCI-R	.00	.96
SHAI	-.45	-.10

*Note.* PAS = Panic and Agoraphobia Scale; OCI-R = Obsessive-Compulsive Inventory-Revised; SHAI = Short Health Anxiety Inventory.

OCD patients. Most OCD patients (60%) were misclassified as having PD. The overall correct classification rate was 78.5%. Thus, the classification of each diagnostic group was improved compared to the random probability.

Table 2 presents the structure matrix, or pooled within-group correlations, between the three predictor variables and discriminant functions. The first significant function reflected primarily higher panic symptoms and lower health anxiety. An examination of group means (group centroids) on the first discriminant function (.61 for PD, .00 for OCD, and -1.50 for HC) indicated significantly higher scores for PD patients than those with HC,  $t(67) = 8.20$ ,  $p < .001$ , and (marginally) significantly higher than those with OCD,  $t(57) = 1.78$ ,  $p < .10$ . OCD was associated with higher scores on this function than HC,  $t(28) = 3.58$ ,  $p < .001$ . The second function reflected primarily higher OCD symptoms. Not surprisingly, group centroids (1.89 for OCD, -.27 for PD, and -.28 for HC) revealed higher scores for OCD patients than those with PD,  $t(57) = 5.63$ ,  $p < .001$ , and HC,  $t(28) = 5.12$ ,  $p < .001$ , with the PD and HC groups yielding essentially equivalent scores. Overall, the patient groups exhibited a clear pattern of high disorder-specific symptoms and lower symptoms of the other two disorders.

### Group Comparisons: Cognitive Measures

Group mean scores for each cognitive measure appear in Table 1. A second series of one-way ANOVAs was conducted to examine diagnostic group differences in these variables. As shown in Table 1, statistically significant between-group differences were evident for body vigilance (BVS), intolerance of uncertainty (IUS), and the ASI-R fear of cardiovascular symptoms subscale. A non-significant trend was also evident on the ASI-R fear of respiratory symptoms subscale. Follow-up Fisher's LSD post hoc tests revealed that PD patients had significantly higher BVS scores than did OCD patients ( $p < .01$ ) but not HC patients ( $p > .05$ ), who did not differ from each other ( $p > .05$ ). PD patients had significantly lower IUS scores than those with OCD ( $p < .10$ ) and HC ( $p < .01$ ), who did not differ from each other ( $p > .10$ ). The fear of cardiovascular symptoms subscale of the ASI-R was significantly higher among HC patients than those with PD ( $p < .01$ ) and OCD ( $p < .001$ ). In contrast, the fear of respiratory symptoms was highest among PD patients, with this difference reaching statistical significance only in comparison to those with HC ( $p < .05$ ).

A second discriminant function analysis using the same procedures described previously was conducted to examine how well the BVS, IUS, and two ASI-R subscales discriminated between the diagnostic groups. After excluding participants with missing data, sample sizes for this analysis were 26 for PD, 19 for HC, and 11 for OCD, yielding prior probabilities of group membership of .46, .34, and .20, respectively.

Both discriminant functions were statistically significant. The first function accounted for 84.0% of the between-groups variability and had a canonical correlation of .76, Wilks'  $\lambda = .34$ ,  $\chi^2(8) = 55.05$ ,  $p < .001$ . The second function accounted for 16.0% of the variance and had a canonical correlation of .45, Wilks'  $\lambda = .80$ ,  $\chi^2(3) = 11.57$ ,  $p < .01$ . Together, the two functions

**TABLE 3. CORRELATIONS BETWEEN COGNITIVE MEASURES AND THE DISCRIMINANT FUNCTIONS**

Predictor	Function 1	Function 2
BVS	-.09	-.41
IUS	.34	.33
ASI-R Respiratory	-.26	.19
ASI-R Cardiovascular	.26	-.30

*Note.* BVS = Body Vigilance Scale; IUS = Intolerance of Uncertainty Scale; ASI-R Respiratory = Fear of Respiratory Concerns subscale of the Anxiety Sensitivity Index–Revised; ASI-R Cardiovascular = Fear of Cardiovascular Concerns subscale of the Anxiety Sensitivity Index–Revised.

correctly classified 88.5% of PD patients and 89.5% of HC patients. Fewer than half of OCD patients (45.5%) were correctly classified, with more of these individuals being misclassified as having PD (36.4%) than HC (18.2%). The overall correct classification rate was 80.4%, resulting in improved classification relative to the random probability for each diagnostic group.

Correlations between the four cognitive variables and the two discriminant functions appear in Table 3. The first significant function reflected primarily higher intolerance of uncertainty, higher fears of cardiovascular symptoms, and lower fears of respiratory symptoms. An examination of group means (group centroids) on this discriminant function (1.52 for HC,  $-.31$  for OCD, and  $-.98$  for PD) indicated significantly higher scores for HC patients than those with PD,  $t(43) = -8.25, p < .001$ , and OCD,  $t(28) = -5.01, p < .001$ . OCD patients evidenced marginally significantly higher scores than PD patients,  $t(35) = -1.84, p < .10$ . The second significant discriminant function reflected primarily higher intolerance of uncertainty, elevated fears of respiratory symptoms, lower fears of cardiovascular symptoms, and lower body vigilance. Group centroids on this function were  $.98, -.15$ , and  $-.30$  for OCD, HC, and PD, respectively. OCD patients scored significantly higher on this function than those with PD,  $t(35) = -3.50, p < .001$ , and HC,  $t(28) = 3.16, p < .01$ . Scores in the PD and HC groups did not significantly differ,  $t(43) = 0.49, p > .10$ .

## DISCUSSION

Clinicians and researchers have noted symptom overlaps among HC, PD, and OCD. Symptoms that appear superficially similar (e.g., somatic focus, repetitive behaviors), however, might have different underlying psychological mechanisms. It is therefore also important to investigate whether seeming similarities among disorders are manifest at the level of cognitive processes hypothesized to underlie disorder-specific symptoms (Beck & Emery, 1985). Accordingly, in the present study we empirically generated a symptom and cognitive profile for each of the previously mentioned conditions using a variety of relevant symptom and cognitive constructs. These profiles were then used to determine the extent to which these constructs discriminated between the diagnostic groups. As anxiety sensitivity, body vigilance, and intolerance of uncertainty have been theoretically implicated as factors underlying HC, PD, and OCD symptoms, we focused on these cognitions in the present investigation.

Our findings are consistent with hypotheses derived from theoretical and empirical observations about the relationship between HC, PD, and OCD. At the symptom level, HC was characterized by elevated health anxiety and much lower levels of PD and OCD symptoms than

those exhibited by patients with these two disorders. Thus, while individuals with health anxiety may experience panic attacks, obsessions, and compulsions, these symptoms are markedly less pronounced among HC patients than among those with PD and OCD. The caveat to this conclusion is that neither the PAS nor the OCI-R were designed to measure the specific panic- or OCD-related symptoms experienced by individuals with HC. As such, our data cannot rule out the very real possibility that HC is associated with, for example, frequent compulsions not assessed on the OCI-R, such as body checking or acquiring disease information on the Internet. The development of HC-specific measures of these phenomena would significantly advance research in this area.

As hypothesized, patients with HC and OCD exhibited elevated and comparable levels of intolerance of uncertainty. Although this cognitive bias has been most extensively documented among patients with generalized anxiety disorder (Dugas, 2004), our findings, in concert with previous research (e.g., Tolin et al., 2003), suggest that elevated intolerance of uncertainty is a feature of OCD and HC as well. Common to these disorders is the frequent experience of doubt, ambiguity, and uncertainty about whether a feared outcome has occurred or will occur. For example, OC checkers may doubt whether they turned off the stove and prevented their house from burning down, whereas individuals with HC may experience uncertainty about whether a bodily sensation of unknown origin signifies a deadly disease. In the face of chronic uncertainty, individuals who are *intolerant* of such feelings may be especially likely to experience anxiety and engage in counterproductive safety behaviors aimed at reducing uncertainty. Therapeutic strategies for reducing the intolerance of uncertainty, such as those identified by Wilhelm and Steketee (2006) for use with OCD patients, may be useful in the treatment of individuals with HC.

Similarities were also observed between HC and PD on cognitive biases related to somatic cues. HC and PD patients evidenced elevated and comparable levels of body vigilance. These findings complement those of Olatunji et al. (2007) and suggest that attention toward somatic cues is most pronounced in anxiety-related disorders characterized by prominent fears of physical catastrophes. As with PD, body vigilance in HC is expected to serve as a maintenance factor by increasing the perception of innocuous somatic cues that most people ignore. This leads to further catastrophic misinterpretations, completing a vicious cycle of noticing somatic cues, catastrophic misinterpretations, anxiety and body vigilance, increased perception of somatic cues, and so on. While PD and HC appear similarly associated with vigilance to arousal-related body sensations, individuals with HC may be additionally hypervigilant to non-arousal-related cues such as fatigue, muscle soreness, and skin discolorations. Unfortunately, our use of the BVS, originally designed to assess vigilance of arousal-related body sensations in PD, precluded exploration of this possibility. Future research should develop assessment tools for HC-related body vigilance and empirically examine the hypothesis that individuals with HC also show vigilance for non-arousal-related sensations.

Our findings indicate that certain dimensions of anxiety sensitivity are elevated among individuals with HC. Specifically, relative to patients with PD, those with HC endorsed significantly greater fears of what Taylor and Cox (1998) referred to as “cardiovascular symptoms.” Inspection of the items on the ASI-R fear of cardiovascular symptoms subscale reveals that many assess fears of somatic phenomena (e.g., stomach pain, numbness, headache, nausea) not necessarily associated with the experience of anxiety but often associated by HC patients with feared diseases such as stroke and cancer. On the ASI-R subscale assessing fears of panic-related respiratory symptoms, HC patients tended to score lower than those with PD. Thus, HC and PD may be distinguished by the extent to which the focus of concern is with arousal-related somatic symptoms leading to feared immediate catastrophes versus non-arousal-related signs and symptoms associated with longer-term medical consequences.

Despite the similarities between HC, PD, and OCD, our discriminant function analyses indicate that HC can be reliably distinguished from these other disorders. By mathematically

combining scores on measures of health anxiety, OC symptoms, and panic symptoms, HC cases were predicted with 70.5% accuracy. Importantly, predictive accuracy increased to 89.5% when cognitive measures replaced symptom measures in the discriminant function. Thus, the combination of high intolerance of uncertainty, body vigilance, and the fear of cardiovascular symptoms appears at least as central to the experience of HC as elevated health anxiety. Our findings highlight the importance of understanding HC at the functional rather than superficial symptom level and suggest that HC symptoms are motivated by the same cognitive processes thought to underlie other anxiety disorders. In light of research demonstrating strong and specific relationships between specific anxiety disorders (but not somatoform disorders) and the intolerance of uncertainty, body vigilance, and anxiety sensitivity, our findings also argue for conceptualizing HC as an anxiety disorder.

A number of limitations to this study deserve mention. First, all the data were collected via self-report measures. This has the potential of inflating relationships among variables, which could influence the results of our discriminant function analyses. Future investigations might attempt replication of the present results using a multimethod approach to assessment. Second, because of missing data on some measures, our sample size (particularly the OCD group) was quite small. Third, although the variety of measures included in the present study represent many of the symptoms and cognitions implicated in HC, PD, and OCD, other potentially important variables were not examined here. For example, it would be interesting to examine the extent to which inflated responsibility and beliefs about the significance of intrusive thoughts—two cognitive variables found to underlie the development and maintenance of OCD symptoms (e.g., Obsessive Compulsive Cognitions Working Group, 2005)—might also be predictive of a diagnosis of HC. Fourth, the results of the present study are confined by the nature of the assessment tools used. As mentioned previously, the symptoms measures we employed were developed (and normed) primarily to measure the disorder-specific symptoms within a population of individuals with that particular diagnosis. How well, for example, the OCI-R measures obsessions and compulsions in an HC sample is not known. This might have influenced our findings of differences in symptom levels between groups. An advantage of measures of cognitive phenomena, however, is that they are more or less transdiagnostic and thus are able to adequately assess particular cognitive phenomena (e.g., anxiety sensitivity) regardless of the diagnostic condition (e.g., PD or HC).

Our findings have implications for conceptualizing, assessing, and treating individuals with HC. Whereas there appear to be overlapping features of HC, PD, and OCD, these clinical entities are distinguishable from one another. Nevertheless, there appear to be overlaps in certain cognitive processes that are thought to underlie the symptoms of these conditions. This suggests that certain cognitive assessment and therapy techniques useful with PD and OCD would also be applicable in the case of HC. Specifically, clinicians should assess for anxiety sensitivity, body vigilance, and intolerance of uncertainty in HC and (to the extent that these cognitive biases are present) apply techniques such as psychoeducation about the body's physiology and interoceptive exposure (which target anxiety sensitivity and body vigilance). Cognitive-behavioral techniques for helping individuals better manage uncertainty and ambiguity include (a) demonstrating the ubiquity of uncertainty, (b) discussing the disadvantages of trying to attain 100% certainty (i.e., a guarantee) of health status, and (c) discussing how the individual routinely manages acceptable levels of uncertainty quite well in other areas of life (e.g., when driving to the session, they are at risk of dying in a crash) but has particular difficulty applying it to health concerns. These verbal techniques can be used to set the table for imaginal and situational exposure in which the person confronts situations and mental stimuli (thoughts and doubts) that evoke distressing levels of uncertainty. Thus, a cognition-based as opposed to symptom-based case formulation approach (e.g., Persons, 1986) would be most helpful.

Although we believe effective psychological treatment for HC will ultimately rely more on idiographic assessment and conceptualization as opposed to how it is categorized in future iterations of the *DSM*, we call for additional empirical studies on HC and its relationship to the somatoform and anxiety disorders. Such research should examine not only the superficial symptom profiles of these conditions but also the psychological (and perhaps biological) mechanisms associated with these symptoms. For example, a large field trial study could be undertaken to compare the presence and severity of cognitive variables, anxiety symptoms, insight/overvalued ideation, comorbid signs and symptoms, and perhaps response to behavioral avoidance tests among samples of individuals with HC, OCD, panic, and other somatoform disorders (e.g., somatization disorder, pain disorder). Factor- and cluster-analytic analyses of these data might be employed to shed light on issues of dimensionality and categorization. To date, clinical accounts indicate that HC has much in common with PD, OCD, and other anxiety states (e.g., illness phobia) regarding both psychopathology and effective treatments. Empirical study, however, has lagged behind clinical observation in this regard. We hope that researchers will continue to investigate these important diagnostic, conceptual, and theoretical questions.

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