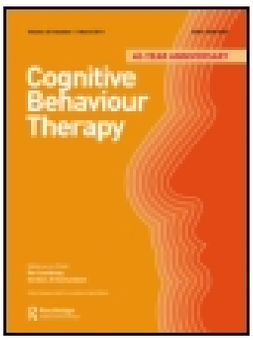

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Hierarchical Model of Generalized and Specific Vulnerabilities in Anxiety

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Abstract. This study evaluated a theoretical hierarchical relationship among the general anxiety vulnerability variable of neuroticism, the specific vulnerability variables of anxiety sensitivity and intolerance of uncertainty, and variables reflecting specific anxiety foci including panic symptoms, health anxiety, obsessive-compulsive symptoms and generalized anxiety/worry. Questionnaires assessing these variables were administered to a non-clinical sample of 91 first-year psychology students (64.8% women). Path analysis results were highly consistent with the hypothesized hierarchical model. Neuroticism was found to have a significant direct effect on both anxiety sensitivity and intolerance of uncertainty. Both neuroticism and anxiety sensitivity had direct significant effects on panic symptoms, neuroticism and intolerance of uncertainty both made significant direct contributions to the prediction of worry, and neuroticism made a significant direct contribution to the prediction of obsessive-compulsive symptoms. Contrary to the hypothesized model, anxiety sensitivity but not neuroticism uniquely predicted health anxiety. The results of this study provide initial empirical evidence for a hierarchical relationship among general and specific vulnerabilities, and specific anxiety manifestations. *Key words: hierarchical path analysis, anxiety, neuroticism, anxiety sensitivity, intolerance of uncertainty, vulnerability factor.*

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Anxiety and its disorders are among the most common mental health problems, with an estimated lifetime prevalence of 24.9% and 1-year prevalence of 17.2% (Kessler et al., 1994). Research over the past several decades has developed a view of the individual anxiety disorders as highly specific, as reflected by changes in successive editions of the Diagnostic and Statistical Manual of Mental Disorders (DSM; American Psychiatric Association, 1965, 1980, 1987, 1994, 2000). The number of anxiety disorders listed has increased with each edition of the DSM, with 3 diagnostic categories in DSM-II, 5 in DSM-III, 6 in DSM-III-R and 12 in DSM-IV. In addition, there has been an increase in the number of subtypes and specifiers associated with certain anxiety diagnoses.

While there have been numerous studies examining the specificity of these disorders, newer etiological models of anxiety disorders are emphasizing common higher-order factors contributing to the development of all anxiety-related disorders (e.g. Barlow, 2000; Craske, 1999; Norton, 2002). The higher-order factor presented in these models is derived from the constructs of negative affect (Clark & Watson, 1991), neuroticism (Eysenck, 1967), and trait anxiety (Gray, 1982). Despite some conceptual differences inherent in these constructs, critical reviews of their primary characteristics suggest that these terms likely reflect the same construct (Barlow, 2000; Zinbarg & Barlow, 1996). This higher-order factor, hereafter termed *neuroticism*,

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is postulated to arise from genetic influences and early childhood learning, and is "posited to comprise both cognitive and physiological features, or tendencies to readily perceive threat, and to be readily aroused" (Craske, 1999; p. 102). Neuroticism can then interact with individual aversive life experiences and bind with specific stimuli or classes of stimuli, resulting in the development of specific fears.

The results of several structural modeling studies provide direct support for this model. Most notably, Brown, Chorpita, and Barlow (1998) found that a model with this neuroticism construct acting as a direct causal influence on generalized anxiety disorder, panic disorder, obsessive-compulsive disorder and social phobia provided excellent fit to their data. A second higher-order factor, positive affect, contributed directly to depression and social phobia. Despite findings that neuroticism does constitute a common component of several anxiety disorders, the view of these disorders as distinct was also supported. The best-fit model of anxiety disorders degraded when the disorders were collapsed into an overall group, differentiated into anxiety and mood disorders, or when specific highly correlated disorders such as generalized anxiety disorder and depression were combined (Brown, Chorpita, & Barlow, 1998). Although this model provides a solid framework from which to understand the etiology of anxiety disorders, Taylor (1998) has suggested that hierarchical models of anxiety need to consider both the disorder-common factors (e.g. neuroticism) but also potential disorder-specific factors. Two such disorder-specific etiological factors may be anxiety sensitivity and intolerance of uncertainty.

Anxiety sensitivity is a fear of anxiety or anxiety symptoms based on the belief that these symptoms have negative consequences (McNally, 1999). Anxiety sensitivity has been conceptualized as a trait due to its relative stability over time (see Taylor, 1999). Higher levels of anxiety sensitivity have been found in many anxiety disorders, including panic disorder, post-traumatic stress disorder, social anxiety disorder, obsessive-compulsive disorder, and generalized anxiety disorder, compared with healthy controls (Cox, Borger, & Enns, 1999). Anxiety sensitivity has also been found to be a strong predictor of hypochondriacal concerns (Otto, Pollack, Sachs, & Rosenbaum, 1992), even when the possible confounding of panic disorder symptoms has been removed (Otto, Demopulos, McLean, Pollack, & Fava, 1998). A study by Taylor, Koch, and McNally (1992) compared anxiety sensitivity levels in 6 anxiety disorders. All disorders, with the exception of specific phobia, showed higher levels of anxiety sensitivity compared with normal controls. Panic disorder patients had marginally higher anxiety sensitivity scores than patients with post-traumatic stress disorder, and significantly greater levels than the patients with generalized anxiety disorder, obsessive-compulsive disorder, social phobia and specific phobia (Taylor, Koch, & McNally, 1992). However, apart from the general comparison with panic disorder, which had a much greater number of subjects than the other groups, the specific anxiety disorders were not compared.

Intolerance of uncertainty (a) is characterized by a tendency to perceive ambiguous situations as threatening so that uncertainty about the outcomes of events is a source of fear or discomfort (Freeston, Rhéaume, Letarte, Dugas, & Ladouceur, 1994), (b) has been identified as a cognitive component in generalized anxiety disorder (Dugas, Gagnon, Ladouceur, & Freeston, 1998), and targeting it has been shown to be of some benefit in the treatment of generalized anxiety disorder (Dugas & Ladouceur, 2000), and (c) has been found to be present in higher levels in patients with generalized anxiety disorder than in patients with other anxiety disorders, though both groups had higher levels than non-clinical subjects (Ladouceur et al., 1999). The other anxiety disorders, however, were grouped rather than considered individually. Thus while current evidence would indicate that intolerance of uncertainty may be a specific feature of generalized anxiety disorder, its influence on other anxiety disorders is not clear.

Taylor (1998), in his review of the hierarchical nature of fears, posed 3 questions for researchers concerning the structure of the fear hierarchy: "(1) how many layers in the hierarchy?, (2) how many factors in each layer?, and (3) which factors load on higher-order factors" (p. 6). In

light of these recommendations, the primary purpose of this study was to provide a preliminary examination of multiple levels of influence on the expression of anxiety symptoms. More specifically, we examined a hypothesized hierarchical relationship of neuroticism on anxiety sensitivity and intolerance of uncertainty, as well as the effect of these 3 hypothesized vulnerability variables on specific anxiety foci – worry, obsessive thinking, panic symptomotology and hypochondriacal fears (see Figure 1) – in order to further elucidate the hierarchical structure of fear and anxiety.

Method

Participants

To sample across the range of anxiety levels, a non-clinical sample was employed for this study. Participants were 91 (64.8% women) introductory psychology students at the University of Winnipeg, Canada, who participated as a means of fulfilling course requirements. All participants provided informed consent. Most participants were single (86.9%) and ranged in age from 18 to 49 years (M = 20.28, SD = 4.56). Seven participants were employed full-time, 49 had part-time employment, 12 had casual employment and 19 were not currently working. Four participants did not provide employment information.

Measures and procedures

Participants completed demographic questions and a battery of questionnaires in a quiet classroom setting. The specific questionnaires were presented in 1 of 4 counterbalanced orders to minimize possible order effects. The measures were selected based on their construct validity and their discriminant validity with the other measures of theoretically related, but conceptually distinct, constructs.

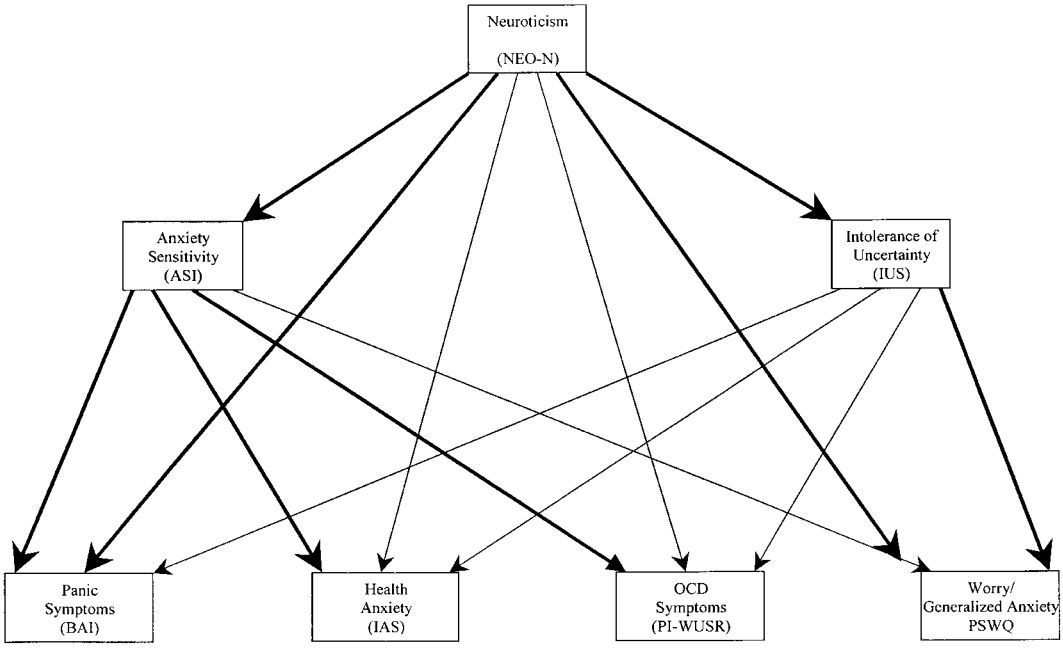

Figure 1. Hypothesized path model.

NEO Five Factor Index Neuroticism scale. The NEO Five Factor Index (NEO-FFI; Costa & McCrae, 1992) is a shortened version of the Revised NEO Personality Inventory. The NEO-FFI measures 5 personality traits – neuroticism, extraversion, openness, agreeableness and conscientiousness. The NEO-FFI and its personality trait subscales have demonstrated high construct validity and reliability with both clinical and normal samples (Costa & McCrae, 1992). Only the Neuroticism scale (NEO-N), consisting of 12 items, was used in the present study. The neuroticism scale shows excellent internal consistency (Cronbach $\alpha = 0.93$; Costa & McCrae, 1992).

Anxiety Sensitivity Index Revised (ASI-R). The ASI-R (Taylor & Cox, 1998), an adaptation of the Peterson and Reiss (1987, 1992) 16-item Anxiety Sensitivity Index, is a 36-item self-report questionnaire designed to assess anxiety sensitivity. Given the amassing evidence suggesting that anxiety sensitivity possesses a hierarchical factor structure (see Taylor, 1999), Taylor and Cox (1998) developed the revised and expanded ASI-R to better assess this. The ASI-R and its subscales have shown good to excellent internal consistency (Cronbach α ranging from 0.80 for fear of gastrointestinal symptoms to 0.91 for fear of respiratory symptoms; Taylor & Cox, 1998) and validity (Taylor & Cox, 1998). Behaviorally, subjects scoring high on the ASI show greater amounts of anxiety in response to questions about anxiety than do subjects scoring low on the ASI (Maller & Reiss, 1987). The ASI has been shown to be factorially distinct from other fears (see Reiss, Peterson, & Gursky, 1988; Taylor, 1993). Specifically, the fear of anxiety was shown to be distinct from fear of rejection/criticism and fear of injury/illness/death when pooled items from the ASI and the Fear Survey Schedule II were factor-analyzed (Reiss et al., 1988). Further research on the structure of fears has provided additional support for Reiss et al.'s (1988) findings (Taylor, 1993). Though there has been some debate about the distinction between anxiety sensitivity and the trait anxiety/neuroticism construct, there is an increasing amount of evidence to support the distinguishability of these constructs. From their factor analyses of the ASI and the Trait scale from the State/Trait Anxiety Inventory (STAI-T) in both clinical and non-clinical samples, Taylor, Koch, and Crockett, (1991) found that the pooled items loaded on 2 separate factors – anxiety sensitivity and the trait anxiety/neuroticism construct – which were only moderately correlated ($r = 0.39$). Based on inter-battery factor analysis assessing the overlap between the scales, Taylor et al. (1991) concluded that the ASI and STAI-T "share method variance and content-relevant similarities, yet are factorially distinct" (p. 303). McNally (1989) has also noted the conceptual distinction between anxiety sensitivity and trait anxiety, namely that "trait anxiety is a general tendency to respond fearfully to anxiety symptoms" (p. 193). Further, Reiss (1997) has noted that trait anxiety and anxiety sensitivity use different indicators to predict anxiety. Specifically, trait anxiety assesses anxiety experiences in the past while anxiety sensitivity assesses beliefs about the consequences of anxiety (Reiss, 1997). Anxiety sensitivity, as measured by the ASI, has also been found to precede and predict panic attacks even when trait anxiety and a history of panic have been controlled for (Schmidt, Lerew, & Jackson, 1999), demonstrating that anxiety sensitivity is distinct from both panic and trait anxiety. For the current study, the ASI-R total scale score was employed as a measure of anxiety sensitivity.

Intolerance of Uncertainty Scale (IUS). The Intolerance of Uncertainty Scale (Freeston et al., 1994) is a 27-item self-report measure that assesses "emotional, cognitive and behavioral reactions to ambiguous situations, implications of being uncertain, and attempts to control the future" (Dugas, Freeston, & Ladouceur, 1994; p. 596). The IUS has demonstrated excellent internal consistency ($\alpha = 0.94$ for the English language version; Buhr & Dugas, 2002) and test-retest reliability, and has shown evidence of convergent, criterion and discriminant validity (Buhr & Dugas, 2002; Freeston et al., 1994). More specifically, IUS scores have consistently shown to correlate to a moderate degree with measures of worry (Buhr & Dugas, in press, $r = 0.60$; Freeston et al., 1994, $r = 0.57$ and 0.63). Further, Ladoucuer, Gosselin, and Dugas (2000) report that variations in intolerance of uncertainty, as measured by the IUS, were causally related to changes in worry.

Penn State Worry Questionnaire (PSWQ). The PSWQ is a 16-item self-report measure of the frequency and intensity of worry, the principle characteristic of generalized anxiety disorder. The PSWQ has demonstrated excellent psychometric properties with use among college students (Meyer, Miller, Metzger, & Borkovec, 1990). Measures of internal consistency have been shown to be good to excellent with Cronbach α ranging from 0.86 to 0.93 across clinical and college student samples (Molina & Borkovec, 1994). The PSWQ has been shown to distinguish patients with GAD, of which worry is the principal characteristic, from other anxiety disorders patients and from healthy controls (Brown, Antony, & Barlow, 1992). Further, the PSWQ was been found to distinguish between subjects meeting all, some, or none of the DSM-IIIR criteria for generalized anxiety disorder (Meyer et al., 1990). The PSWQ has also been shown to be uncorrelated with measures of both anxiety and depression (Brown et al., 1992; Meyer et al., 1990). The PSWQ was used as a measure of worry/generalized anxiety.

Washington State University Revision of the Padua Inventory (PI-WSUR). The original Padua Inventory (Sanavio, 1988) is a measure of obsessiveness and the extent to which people exhibit compulsive behaviors. The PI-WSUR is an abbreviated version of the Padua Inventory, revised to better discriminate worry from obsessiveness, and has demonstrated acceptable psychometric properties (Burns, Keortge, Formea, & Sternberger, 1996). The PI-WSUR consists of 39 items assessing 5 dimensions of obsessive-compulsive tendencies, including (a) obsessions about causing harm, (b) impulses to cause harm, (c) obsessions about contamination and washing compulsions, (d) checking compulsions and (e) compulsions about dressing and grooming. Both the total score (Cronbach $\alpha = 0.92$) and the 5 subscales (α from 0.77 to 0.88) have shown high internal consistency, stability, and discriminant validity (Burns et al., 1996). Patients with OCD have been shown to score higher on the PI-WSUR than normal controls (Burns et al., 1996). Previous research with the original Padua Inventory has also shown that patients with OCD score significantly higher than patients with social phobia, panic disorder, or normal controls (van Oppen, Hoekstra, & Emmelkamp, 1995), though further research is needed with the revised version. With regard to its independence from worry, PI-WSUR items were found to be significantly more correlated with both their own subscales and PI-WSUR total score than with the PSWQ (Burns et al., 1996). The PSWQ items also showed significantly higher correlations to the PSWQ total score than to the PI-WSUR subscales or total score (Burns et al., 1996). Furthermore, despite a significant correlation between the 2 scales, the PI-WSUR and the PSWQ shared only 12% of their variance (Burns et al., 1996). The PI-WSUR was used in this study as a measure of obsessive-compulsive symptoms.

Illness Attitudes Scale (IAS). The IAS (Kellner, 1986, 1987) is a 27-item measure of hypochondriacal fears that has demonstrated acceptable reliability and validity among clinical and non-clinical samples (see Stewart & Watt, 2001). The IAS provides a total score reflecting attitudes and beliefs specific to hypochondriasis, and may also be computed along several subscales (Kellner, 1986, 1987). Recent factor analyses suggest that the original 9-factor composition of the IAS (Kellner, 1986, 1987) may be unsound and that a 4-factor structure may be more appropriate (Stewart & Watt, 2001). Both the higher-order factor and some lower-order factors of the IAS have been shown to correlate with anxiety sensitivity as measured by the ASI (Stewart & Watt, 2000), leading some researchers to suggest that these IAS may be assessing some of the same factors as the ASI. However, these relationships were found to persist even when controlling for trait anxiety and for past history of panic attacks (Stewart & Watt, 2000), suggesting that anxiety sensitivity is assessing an independent construct. Further, Stewart and Watt (2000) have noted that the ASI and IAS are specific in referring to anxiety symptoms and illness symptoms, respectively. These measures also reflect the distinction between immediate versus future consequences of bodily symptoms or anxiety that distinguishes panic disorder and hypochondriasis (Stewart & Watt, 2000). Watt and Stewart (2000) have also demonstrated the ASI to be a mediator between childhood learning experiences and hypochondriacal concerns in

adulthood, lending support to the position that the ASI is a predisposing vulnerability factor for illness concerns rather than a confounded variable assessing the same health anxiety construct. For the purposes of this study, the total scale score of the Illness Attitudes Scale was used as a measure of health anxiety/hypochondriasis.

Beck Anxiety Inventory (BAI). The BAI is a reliable 21-item self-report measure designed as a general measure of anxiety symptom severity (Beck, Epstein, Brown, & Steer, 1988; Beck & Steer, 1990). The BAI has demonstrated good psychometric properties with non-clinical college populations (see Creamer, Foran, & Bell, 1995). The BAI demonstrated good internal consistency with Cronbach α of 0.92 for mixed psychiatric patients (Beck, Epstein, Brown & Steer, 1988) and 0.85 to 0.93 for an anxiety disorders sample (Beck & Steer, 1993) though low test-retest reliability, suggesting it to be a measure of state anxiety (Creamer et al., 1995). A 1-factor structure rather than the usual 2-factor structure of the BAI (physical and cognitive symptoms) was found in this non-clinical population. Despite a moderate correlation between the BAI and trait anxiety as measured by the State/Trait Anxiety Inventory, factor analysis found these constructs loaded on separate factors suggesting that the BAI is distinct from trait anxiety (Creamer et al., 1995). Though intended to be a measure of anxiety, recent analyses suggest the BAI to be a measure of panic symptomatology rather than of anxiety in general (Cox, Cohen, Direnfeld, & Swinson, 1996a). Cox et al. (1996a) found that the BAI had a factor structure similar to that of the Panic Attack Questionnaire, as 20 of the 21 BAI items loaded on its 3 factors – dizziness-related sensations, catastrophic cognitions/fear and cardiorespiratory distress. Though there is some debate over this issue (see Steer & Beck, 1996), Cox, Cohen, Direnfeld, and Swinson (1996b) maintain that the BAI fails to make a qualitative distinction between panic and general anxiety symptoms and instead "over-samples panic symptoms and does not sufficiently capture other anxiety disorder domains" (p. 960). Cox et al. (1996b) thus conclude that "in panic disorder samples, the BAI is confounded with or actually measures panic attack symptoms rather than additional anxiety" (p. 960). The BAI was therefore employed as a measure of the panic symptoms.

Data analytic methods. To explore the hypothesized relationship among the variables, regression-based path analyses were employed using SPSS 10.0. Given our limited sample size and the pronounced effects of small samples on the stability of structural models or path analyses derived using LISREL or other structural modeling programs (Kline, 1998; Loehlin, 1998, Schumacker & Lomax, 1996), regression-based path analyses provided the best compromise between analytical sophistication and the constraints imposed by our data. In addition, single indicators were used to represent the variables of interest in an effort to maximize the subject-to-variable ratio (see Kline, 1998). Although more sophisticated structural modeling analyses with multiple indicators of latent constructs would provide a clearer view of the interrelationships, our intent was to provide a preliminary examination of a hierarchical relationship among anxiety and anxiety vulnerabilities prior to our or others' commitment of the resources necessary to collect data from a larger sample using multiple, and multi-modal, measures of the constructs of interest.

Results

Preliminary analyses

Data screening and outlier analysis. All measures were initially assessed for multivariate outliers, univariate outliers and distribution skew. First, the data were assessed for multivariate outliers by entering all measures into a multiple regression and computing Mahalanobis distance. A chi-square cut-off of $p < 0.001$ was used as the criteria for multivariate outliers (Tabachnick & Fidell, 1996), and no multivariate outliers were identified. Univariate outliers were identified by taking 1.5 times the inter-quartile range, and declaring as outliers all data points either this distance above the upper quartile or this distance below the lower quartile (Hoaglin, Mosteller, &

Tukey, 1983). Thirteen data points were identified as univariate outliers. Univariate outliers were Windsorized, replacing the outlying data with non-outlying values while retaining the sequential order among the outliers (Hoaglin et al., 1983). Finally, univariate summary statistics were computed to identify non-normally distributed measures. Measures that were non-normally distributed (i.e. skew $>|0.7|$) were square root or square transformed depending on the direction of the skew. The PI-WSUR (+0.899), and BAI (+0.817) were both positively skewed. The variables were square root transformed, and the resulting distributions were within skew tolerances.

Sample characteristics. Multivariate analysis of variance (MANOVA) was computed to explore potential differences across the 4 counterbalanced order versions of the questionnaire packets. Results indicated that there were no significant differences among the 4 counterbalanced versions of the questionnaire package, F (21, 249) = 1.28, $p = 0.187$, *Pillai* = 0.293. All data were therefore collapsed across order of presentation. A second MANOVA was computed to assess gender differences across the variables used in this study. The MANOVA revealed a significant multivariate gender difference, F (7, 82) = 3.46, $p = 0.003$, *Pillai* = 0.228. Follow-up univariate analyses of variance indicated that women scored significantly higher than men on the NEO-N, F (1, 88) = 6.00, $p = 0.016$, ASI-R, F (1, 88) = 5.50, $p = 0.021$, PSWQ, F (1, 88) = 7.68, $p = 0.007$, IAS, F (1, 88) = 12.49, $p = 0.001$, and BAI, F (1, 88) = 5.88, $p = 0.017$. Although these variables showed mean differences across gender, it is possible that the differences were systematic and did not vary the magnitude of the relationships among the variables across men and women. To test this possibility, zero-order correlations among the variables were computed separately for men and women and then converted to z-distribution scores. Z-scores were compared using the Fisher z-test of independent-sample correlations. Analyses revealed that the magnitude of the relationship between the BAI and PI-WSUR differed between men, $r = 0.162$, and women, $r = 0.556$, $Z = 0.204$. No other significant differences in the magnitude of the relationships among the variables between men and women were found. Given that the correlation matrices for men and women were largely devoid of significant differences, the data from men and women were combined for all further analyses. Table 1 presents the univariate summary statistics for the total sample as well as the correlation matrix used to test the hypothesized and full hierarchical path models.

Path analyses

Hypothesized path model. The hypothesized hierarchical model (Figure 1) was analyzed using regression-based path analysis (see Kline, 1998). Figure 2 presents the hypothesized model with standardized path coefficients. Examination of the effects among vulnerability variables indicated that, as hypothesized, NEO-N had a significant direct effect on anxiety sensitivity, accounting for

Table 1. *Correlation matrix and univariate summary statistics.*

	NEO-N	ASI-R	IUS	BAI	IAS	PI-WSUR	PSWQ
ASI-R	0.566 **						
IUS	0.534 **	0.487 **					
BAI	0.580 **	0.549 **	0.429 **				
IAS	0.414 **	0.583 **	0.273 *	0.492 **			
PI-WSUR	0.374 **	0.478 **	0.284 *	0.443 **	0.411 **		
PSWQ	0.665 **	0.535 **	0.569 **	0.554 **	0.546 **	0.332 *	
Mean	25.04	42.07	58.24	13.84	30.26	24.75	47.32
(SD)	(9.40)	(23.34)	(18.05)	(9.11)	(13.77)	(15.20)	(14.89)

PSWQ = Penn State Worry Questionnaire; PI-WSUR = Padua Inventory Washington State University Revision; IAS = Illness Attitude Scale; NEO-N. = Neuroticism scale from the NEO FFI; ASI-R = Anxiety Sensitivity Index Revised; IUS = Intolerance of Uncertainty Scale; BAI = Beck Anxiety Inventory. * $p < 0.01$, ** $p > 0.001$.

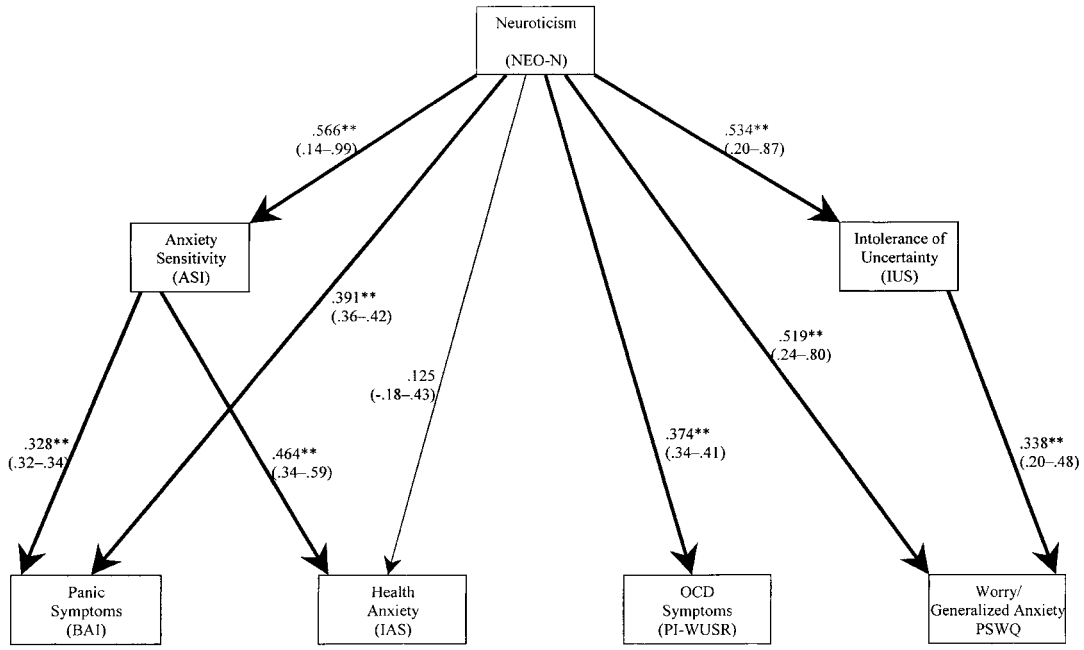

Figure 2. Hypothesized model with path coefficients (* $p < 0.05$, ** $p < 0.01$). Note: values represent standardized path coefficients. Thick/bold arrows represent paths with significant ($p < 0.05$) path coefficients. Values in parentheses represent 95% confidence intervals.

32.0% of the variability of the ASI. In addition, NEO-N had a direct significant effect on intolerance of uncertainty, accounting for 28.6% of the variability on the IUS.

Examination of effects of the vulnerability variables on specific anxiety manifestations indicated strong, albeit not complete, support for the hypothesized model. Both the NEO-N and ASI had direct significant effects on panic symptoms, accounting for 40.8% of the variability in BAI. NEO-N and IUS, as hypothesized, both made significant direct contributions to the prediction of worry/generalized anxiety, together accounting for 50.5% of the variability in PSWQ. Finally, as hypothesized, NEO-N made a significant direct contribution to the prediction of obsessive-compulsive symptoms, accounting for 14.0% of the variability in PI-WSUR. Contrary to the hypothesized model, however, ASI but not NEO-N made a significant direct contribution to the prediction of health anxiety/hypochondriasis, accounting for 35.0% of the variability in IAS.

Full hierarchical model. To more fully explore the hierarchical relationship among the variables, the full hierarchical model was analyzed using regression-based path analysis. The full hierarchical model differed from the hypothesized model in that both of the specific vulnerabilities, ASI and IUS, were allowed to influence all of the specific manifestations. The full hierarchical model is presented with standardized path coefficients in Figure 3.

Examination of the full hierarchical model indicated that, by and large, the significant path loadings mirrored those predicted in the hypothesized model. NEO-N and ASI made direct significant contributions to the prediction of panic symptoms, while IUS failed to make a significant contribution. Overall, the full hierarchical model accounted for 41.3% of the variability in BAI. NEO-N and IUS, but not ASI, made significant direct contributions to the prediction of worry/generalized anxiety, with the total model accounting for 52.3% of the variability in PSWQ. As was found in testing the hypothesized model, but deviating from the

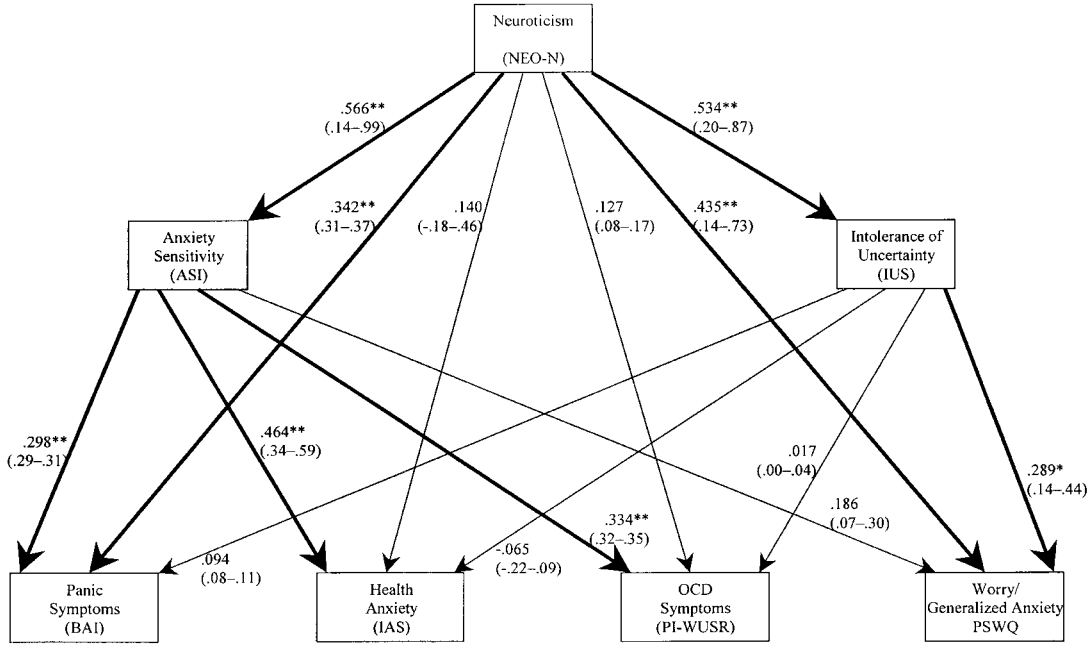

Figure 3. Full hierarchical model with path coefficients (* $p < 0.05$, ** $p < 0.01$). Note: values represent standardized path coefficients. Thick/bold arrows represent paths with significant ($p < 0.05$) path coefficients. Values in parentheses represent 95% confidence intervals.

original hypothesized model, only ASI had a significant direct effect on the prediction of health anxiety/hypochondriasis. Overall, the full hierarchical path model accounted for 30.7% of the variability in IAS. Unlike the hypothesized model, however, ASI but not NEO-N or IUS made a significant direct contribution to the prediction of obsessive-compulsive symptoms. In total, the full hierarchical model accounted for 17.2% of the variability in PI-WSUR.

Comparison of hypothesized and full hierarchical models. To compare the predictive power of the 2 models, we computed the total variance accounted for by the hypothesized, $R^2_{\mathrm{M}} = 0.920$, and full hierarchical models, $R^2_{\mathrm{M}} = 0.934$. While highly similar, the difference between the models was significant, $R^2_{\mathrm{Difference}} = 0.01312$, $F\ (5,\ 76) = 3.00$, $p < 0.05$, indicating that the full hierarchical model predicted a significantly greater proportion of the variance than did the hypothesized model, although the difference itself was relatively small.

Discussion

An accumulating body of theoretical (e.g. Barlow, 2000; Craske, 1999) and empirical (Brown et al., 1998) research is suggesting a hierarchical relationship between anxiety disorders and trait-like factors that may promote their development. While the majority of this research has examined the direct influence of neuroticism, or similar constructs, on anxiety disorders, some (e.g. Taylor, 1998) have called for a more detailed examination of fears as arising from multiple orders of influencing factors. Based on the aforementioned works examining the hierarchical structure of fears, as well as works examining the more proximal influence of anxiety sensitivity and intolerance of uncertainty, we proposed and evaluated a hierarchical model of anxiety and vulnerabilities toward the development of different types of anxiety symptoms.

Overall, the results of the path analyses are generally consistent with theoretical models of anxiety disorders and their relationships with both an overarching common vulnerability as well

as specific vulnerabilities that relate to the manifestation of specific anxiety symptoms. According to our model, there is evidence supporting neuroticism as a global vulnerability that directly influences the development of specific anxiety manifestations, including panic symptoms, health anxiety/hypochondriasis, obsessive-compulsive symptoms, and worry/generalized anxiety. Additionally, however, neuroticism is seen as influencing the development of specific vulnerability variables anxiety sensitivity and intolerance of uncertainty, which apply influence on the development of specific anxiety manifestations. More specifically, in our model, anxiety sensitivity is seen as influencing panic symptoms and health anxiety/hypochondriasis, while applying no influence on obsessive-compulsive symptoms or worry/generalized anxiety. Intolerance of uncertainty, on the other hand, is seen as influencing worry/generalized anxiety, but applying no influence on panic symptoms, health anxiety/hypochondriasis, or obsessive-compulsive symptoms.

To test further the hierarchical relationship among these factors, a full hierarchical model was developed to explore the possible non-hypothesized influences of the specific vulnerability variables on specific anxiety manifestations. Analysis of the path structure revealed 1 significant pathway that was not included in the original hypothesized model – a significant influence of anxiety sensitivity on obsessive-compulsive symptoms. Although this pathway was unexpected, the observed relationship is not without theoretical support. As proposed by Cox *et al*. (1999), anxiety sensitivity may likely be present in obsessive-compulsive symptoms as a fear of cognitive dyscontrol. This fear of cognitive dyscontrol may stem from the experience of unwanted, intrusive thoughts characteristic of obsessive-compulsive symptoms coupled with an inflated sense of responsibility for those thoughts. Thus, an individual may come to fear the intrusive thoughts and their perceived negative consequences. The fear of cognitive dyscontrol must, therefore, overlap with anxiety sensitivity. Given the results of this study, the possible role the fear of cognitive dyscontrol may play in the maintenance and/or development of obsessive-compulsive symptoms bears further investigation.

The hypothesized and full hierarchical models were also statistically compared in order to examine which provided closer fit to the data. As expected, given the addition of the significant pathway from anxiety sensitivity to obsessive-compulsive symptoms, the full hierarchical model accounted for a significantly greater proportion of the variance than did the hypothesized model. This difference, however, was relatively small and both models accounted for a vast majority of the total variance. Perhaps future studies should utilize a theory-based model trimming approach (see Kline, 1998) to identify the most parsimonious model that still provides acceptable fit.

Several limitations must be borne in mind while considering the results of this study, particularly in light of the fact that this study represents a preliminary examination of a possible hierarchical relationship among anxiety vulnerability variables. First, although we attempted to select appropriate measures to assess the constructs of interest, the data are limited by the use of single measures as opposed to latent variables derived from multiple indicators. In addition, the use of self-report questionnaires alone may have inflated the observed relationships among the variables due to shared-method variance. To compensate for these limitations, future studies attempting to replicate and extend upon this study should incorporate the use of multiple and multi-modal measures and structural modeling analyses to develop more refined estimates of the latent constructs and their interrelationships. Samples much larger than that employed here, however, will be necessary to yield stable structural models (see Kline, 1998; Loehlin, 1998; Schumaker & Lomax, 1996). Given our preliminary evidence supporting such a hierarchical relationship, the commitment of the necessary resources to obtain multiple and multi-modal measurements from large samples appears justified.

A second limitation was that only 4 anxiety manifestations – panic symptoms, health anxiety/hypochondriasis, obsessive-compulsive symptoms, and worry/generalized anxiety – were included in the analyses. Future studies should utilize an expanded model that includes other

manifestations such as social anxiety/negative evaluation fears or situational fears, as well as other potential generalized and specific vulnerabilities that may bear influence on the development of anxiety disorders.

The use of a non-clinical student sample could also be seen as a limitation of this study; indeed, future studies should strive to replicate our findings with a variety of clinical samples. Our use of a college student sample, however, was designed to more fully capture the range of severity in anxiety manifestations in the general population. Although we did not conduct diagnostic assessments to verify the presence of clinically severe anxiety disorders in the sample, estimates from large-scale prevalence studies (e.g. Kessler et al., 1994) would suggest that clinically severe anxiety disorders would be present in the our sample. In addition, a growing number of studies (e.g. Cox, Enns, Borger, & Parker, 1999; Enns, Cox, & Borger, 2001; Norton, Pidlubny & Norton, 1999; Stein, Torgrud, & Walker, 2000) support the conceptualization of anxiety and depressive conditions as existing on continua of severity. This underscores the validity of employing non-clinical participants as analogues of individuals with anxiety or depressive disorders.

Overall, the results of this study provide initial empirical evidence for a hierarchical relationship underlying fears, with neuroticism serving as a general vulnerability that exerts influence across the anxiety manifestations, as well as specific etiological variables such as intolerance of uncertainty and anxiety sensitivity. Clearly this line of investigation requires replication and extension, perhaps employing alternative or additional measures, clinical and non-clinical populations encompassing a broader range of anxiety manifestations, and other theoretical disorder-specific vulnerabilities. In addition, and perhaps more importantly, future research should examine which level of the hierarchy provides the most clinically useful data. Should our treatment efforts continue to focus on specific diagnoses, or might treatments targeted toward specific vulnerabilities (e.g. Dugas & Ladouceur, 2000) or neuroticism in general be more clinically parsimonious?

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