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ABSTRACT

Title of Thesis: The Pathoplasty Relationship between Anxiety Sensitivity and Panic Disorder.

Mark J. Bates, Masters of Science, 2000

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Anxiety sensitivity (AS), a belief that symptoms of anxiety (e.g., autonomic arousal) can be harmful (Reiss & McNally, 1985), predisposes individuals to the development of panic disorder (PD). A pathoplasty relationship between two variables is defined when a dispositional variable is associated with the expression or course of a clinical condition. The theoretical and empirical literature on the pathoplastic relationship between AS and PD has only addressed limited aspects of the expression and course of PD in relation to the total AS score. In addition, there has been no evaluation of the pathoplastic relationship between lower-order empirically-established AS dimensions and the full range of PD expression and course. This study examined the pathoplasty relationship of total AS and its lower-order sub-factors with variables representing a full range of the expression and course of panic disorder. One hundred and thirty one adults with formally-diagnosed PD volunteered for participation in a PD assessment and treatment research protocol. Information on the expression and course of PD (Panic frequency, intensity, anticipation, avoidance, and core fears) was derived from clinician-rated and self-report measures collected at pre- and post-treatment phases of the study. The three major findings include: (1) AS is related to the major features of PD expression and

course, (2) changes in AS correspond to changes in these features, and (3) AS lower-order factors possess specific relationships with features of PD expression and course. These findings suggest that AS is related to the maintenance and treatment of PD. In addition, the specific relationships among AS lower-order factors and PD expression and course features help clarify the means by which AS contributes to the maintenance and treatment of PD, which may lead to improved assessment and treatment models.

THE PATHOPLASTY RELATIONSHIP

BETWEEN ANXIETY SENSITIVITY AND PANIC DISORDER

By

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1. Introduction

Anxiety sensitivity (AS) represents the extent to which a person believes that sensations associated with anxiety (e.g., autonomic arousal) can have harmful consequences (Reiss & McNally, 1985). Levels of AS are measured by the anxiety sensitivity index (ASI; Reiss, Peterson, Gursky, & McNally, 1986). AS has been conceptualized as a stable individual difference variable (Reiss et al, 1986) that predisposes individuals to the development and maintenance of anxiety pathology (Reiss, 1987, 1991), especially panic attacks and panic disorder (PD). The Diagnostic and Statistical Manual of Mental Disorders (DSM-IV, APA, 1994) describes a panic attack as "the sudden onset of apprehension, fearfulness, and terror." The PD criteria includes experiencing regularly occurring panic attacks and persistently worrying about the recurrence or consequences of panic (APA, 1994). Individuals with heightened AS are believed to misinterpret normal symptoms of anxiety (e.g., heart pounding) as dangerous (e.g., impending heart attack). The misinterpretations of the danger associated with symptoms of anxiety leads to an increase in anxiety (e.g., breathlessness) and a further increase in the expectation of harmful consequences (e.g., death) in a viscious cycle of alternating and escalating anxiety symptoms and fearfulness (Reiss, 1987, 1991). PD thus develops as the individual with a strong disposition for AS (high ASI) becomes increasingly fearful of the symptoms of anxiety associated with a panic attack.

1.1 Possible Relationships between AS and PD

Clark, Watson, and Mineka (1994) outline four possible relationships between a dispositional variable and a psychological disorder. The possible relationships include causal, maintenance, consequential, and third variable interactions. In the research literature, these relationships are also referred to as the vulnerability (causal), pathoplasty (maintenance variant of vulnerability), symptom/scar (consequential), and spectrum/continuity (third variable) models (Enns & Cox, 1997). These relationships provide a useful framework for distinguishing the different possible relationships between AS and PD and are best illustrated by corollary examples between personality variables (dispositions) and medical conditions (disorders) from the health psychology and medical literature.

The causal (vulnerability) model proposes that the level of a dispositional variable predicts the likelihood of developing the disorder. An example of the causal model from health psychology is that the personality dimension of hostility (dispositional variable) appears to be a risk factor for coronary heart disease (Helmers, Posluszny, and Krantz, 1994).

The pathoplasty (a maintenance variant of vulnerability) model proposes that a dispositional variable modifies the expression and course of the disorder without necessarily having a direct etiological role. A major distinction between the vulnerability (causal) and pathoplasty (maintenance) models is the principle that what causes a disorder and what maintains or exacerbates a disorder are not necessarily one and the same thing. An example of a pathoplastic relationship is the relationship between conscientiousness and neuroticism (dispositional variables) and the course of type-1

diabetes (clinical condition). Based on the premise that personality dimensions may affect a diabetic person's compliance with glycemic control regimens, Brickman, Yount, Blaney, Rothberg, and De-Nour, A. K. (1996) found that measures of conscientiousness and neuroticism were associated with the rate of renal deterioration.

The symptom or scar (consequential) model proposes that the development of the disorder causes changes in a dispositional variable. An example of a consequential relationship is a research finding that a sample of patients undergoing treatment for recurrent cancer reported increased levels of dispositional pessimism (Schulz, Williamson, Knapp, Bookwala, et al, 1995).

Lastly, the spectrum or continuity (third variable) model proposes that simultaneous changes in the dispositional variable and the disorder reflect a common underlying process or third variable. In a review of neurological conditions presenting as psychiatric disorders, Skutser, Digre, and Corbett (1992) reported that frontal lobe disturbances (e.g., lesions, tumors, trauma, stroke) can cause simultaneous changes in personality, motor activities, and cognitive function. For example, frontal lobe disease can be associated with personality changes (disposition) involving poor judgment and inappropriate behavior as well as medical problems (disorders) such as bowel and bladder incontinence. Overall, the review highlighted the importance in assessment of considering the involvement of a third variable, especially an underlying neurological disease.

An important consideration is that these hypothetical models are not mutually exclusive. The possibility of multiple forms of relationships among dispositional variables and psychological conditions is suggested by research on the relationship

between AS and PD. This research suggests that AS plays a role both in the causation and maintenance of PD.

1.2 Support for a Causal Relationship between AS and PD

Empirically, there is strong evidence that AS is a risk factor for the development of anxiety disorders. Maller and Reiss (1992) prospectively evaluated nonclinical samples of college students with no history of panic and found that AS was a risk factor for the subsequent development of panic. Maller and Reiss (1992) found that individuals with high ASI scores were five times more likely to develop an anxiety disorder during the 3-year follow-up period. However the small sample size at follow-up (N = 48) limited confidence in these results.

In a follow-up study with a larger sample, Schmidt, Lerew, and Jackson (1997) found that ASI scores predicted the likelihood of panic attacks and other anxiety-related symptoms. The sample included over a thousand Air Force Academy first-year students who were assessed before and after a stressful five-week initial training program. The students with ASI scores in the highest quartile before training started had nearly twice the risk for developing spontaneous panic after the training program than the remaining students who had participated in the study. However, ASI accounted for only a limited amount of the variance in panic, which may have been partly due to the unique characteristics of the mostly male sample of military officer recruits.

An important additional finding by Schmidt et al. (1997) was that ASI scores also predicted a range of measures of functioning and disability. ASI scores predicted the functional domains of overall performance, physical health, and relationships with peers

and supervisors. In addition, ASI scores were related to three of four indexes of disability including visits to peer counselors, visits to the health clinic, and numbers of days on sick call.

ASI scores have also been found to predict increased symptoms of anxiety following various biological challenges. For example, ASI scores have predicted anxiogenic responses (e.g., reports of state anxiety) to hyperventilation and carbon dioxide challenges with both anxiety patients and non-clinical subjects (Rapee, Brown, Antony, & Barlow, 1992).

1.3 Support for a Pathoplastic Relationship between AS and PD

The pathoplasty model posits correlational relationships between AS and the features of PD. First, based on the conceptualization of the relationship between AS and PD and evidence supporting AS as a risk factor for PD, the correlations between AS and PD are presumed to reflect a pathoplastic rather than a spectrum/continuity relationship. Moreover, findings from previous studies suggest that AS has a pathoplastical relationship with two general aspects of PD, the expression and course of the disorder. Lastly, lower-order factors of the ASI have been identified by several studies and these ASI lower-order factors may have distinct pathoplastic relationships with expression and course of PD.

The expression of a disorder reflects a cross-sectional representation of symptoms associated with PD. Ample evidence supports a strong relationship between the ASI and many aspects of PD expression. First, ASI scores have discriminated people with frequent panic from people with infrequent or no panic (Telch, Lucas, & Nelson, 1989).

Second, Jones and Barlow (1991) found that the ASI predicted the diagnostic severity of panic disorder. Lastly, the ASI has also been found to be associated with levels of phobic avoidance, general anxiety and depressive symptoms in agoraphobics (McNally & Lorenz, 1987) and with panic frequency, general anxiety and depressive symptoms, and DSM-IIIR axis I comorbidity in patients with PD and phobias (Ehlers, 1995).

In contrast to the expression of a disorder, the course of a disorder can be described as the overall longitudinal presentation and evolution of a disorder including age and mode of onset, continuity of symptoms, number and duration of episodes, and the overall change in severity over time (APA, 1994). From a longitudinal perspective, the ASI also appears to be associated with the course of PD. McNally and Lorenz (1987) found that ASI scores of patients with agoraphobia normalized after treatment. Likewise, in a study with panic and phobic patients, Ehlers (1995) found that the level of ASI was associated with panic attack maintenance and relapse.

The majority of studies that investigate the role of ASI in PD suggest that the ASI total score is related to variables representing the expression and course of PD. However, the literature about the ASI factor structure appears to support a multifactorial solution (see Taylor, 1996 for a review).

Studies suggest that the ASI can be factor analyzed into three lower-order factors (see Taylor, 1996 for a review). In general, the ASI lower-order factors correspond to fearful cognitions about physical symptoms, mental-incapacitation, and social concerns. Using exploratory and confirmatory factor analyses, Zinbarg, Barlow, and Brown (1997) found a three-factor solution that was consistent with the multiple factor solutions reviewed by Taylor (1996) and that loaded on a single higher-order factor in a

hierarchical solution. When the authors compared the ASI factor scores of different patient groups, a panic group scored significantly higher on the physical concerns factor than all other patient groups. In addition, a social phobia group scored highest overall on the factor associated with social concerns and also were significantly higher on this factor than four other anxiety disorder groups. Stewart, Taylor, and Baker (1997) replicated the general hierarchical solution of Zinbarg et al. (1997) and also found that the higher- and lower-order factor structures were nearly identical across genders in their sample of university students. Therefore, there is growing evidence that there are three viable ASI sub-factors across clinical and non-clinical samples as well as across genders in non-clinical samples.

To date, there has been limited research examining the relationship between specific dimensions of the ASI and the expression and course of PD, although an exploration of the relationships between ASI sub-dimensions and PD is conceptually and clinically warranted. A conceptual reason for attempting to find relationships between ASI sub-factors and PD features is based on Cattell's (1978) premise that factors represent a discrete class of causal mechanisms and Taylor's (1998) suggestion that lower-level factors may reveal a greater specificity of causation than higher-level factors. Likewise, from a clinical perspective, a better understanding of the relationship between ASI sub-dimensions and PD would be expected to lead to more precise case conceptualization and targeted treatment approaches.

Even though there is little direct empirical research on the relationship between the ASI sub-factors and PD, some indirect evidence is suggested from studies of catastrophic cognitions that are similar to the fears represented by the ASI sub-factors. For example,

Robinson and Birchwood (1991) found relationships between cognitions of physical catastrophe and somatic symptoms, cognitions of losing control and "experiential" symptoms (depersonalization and derealization), cognitions of insanity and depressive symptoms, and cognitions of social embarrassment and avoidance behavior. Consistent with Rachman's (1988) suggestion that cognitions might influence the nature and extent of phobic avoidance, fears of social catastrophe were related to a wide range of avoidance behavior whereas cognitions of "death" were related to avoidance of situations when unaccompanied. Similarly, compared to PD patients without agoraphobic avoidance, PD patients with agoraphobia endorsed more catastrophic ideation about social ridicule and loss of control but not about physical consequences of panic (Telch, Brouillard, Telch, Agras, & Taylor, 1989).

In summary, AS research suggests that AS is both a risk factor and maintenance factor for PD. Two prospective studies found that AS was a risk factor that predicted the development of anxiety pathology in nonclinical subjects. Several studies have found that AS also has a pathoplastic relationship with PD because AS is related to many features representing the expression and course of PD. AS also has been related to a broad range of variables representing the expression and course of PD, and AS is composed of three sub-factors that might also be related to PD features. One of the prospective studies using the ASI reported that AS was associated with a range of indices of overall functioning and disability in non-clinical subjects. Therefore, AS can be potentially related to PD features that are not only primary to the disorder, but also features that are secondary to the disorder. In addition, factor analytic studies of the ASI have indicated that the ASI is composed of three subfactors that represent different types

of core fears. There is indirect evidence suggesting that factors may have specific pathoplastic relationships with different aspects of the expression and course of PD.

Despite the growing support for a general pathoplastic relationship between AS and PD, the research about the nature of the pathoplastic relationship between AS and PD is limited in two important areas. Although research has found that AS is related to a range of PD features, including general functioning in nonclinical subjects, AS studies have not directly examined the extent of the relationship between AS and a comprehensive range of PD features in clinical populations. In addition, factor analytic studies have indicated that the ASI is composed of three subfactors representing distinct fears, but studies have not examined the relationships that these subfactors may have with the features of PD.

1.4 Present Study

The goal of this study was to explore the pathoplasty relationship (the maintenance relationship between a dispositional variable and the expression and course of a psychiatric condition) between AS and PD on a comprehensive and detailed level. A comprehensive analysis was achieved by examining the relationship between ASI and a broad range of features associated with PD. The detail of analysis was improved by using both the total and sub-factor ASI scores. Therefore, the first hypothesis of the study was:

H1: The ASI total would be associated with the majority of PD features.

This hypothesis was divided into two sub-hypotheses:

H1a: The ASI total would be associated with the majority of variables representing the expression of PD.

H1b: Changes in the ASI total would be associated with post-treatment changes in the majority of variables representing the course of PD.

In addition, there is empirical evidence supporting three lower level factors of the ASI. These factors have been conceptualized as fears concerning physical, cognitive, and social catastrophes. Based on this three-factor structure, the second hypothesis was:

H2: The three lower-order factors of the ASI would each be associated with measures of other constructs representing similar fearful cognitions.

The previously discussed findings and hypotheses suggest that the AS lower-order factors would have significant relationships with several features of PD. Specifically, Robinson and Birchwood (1991) found significant relationships between cognitions regarding physical symptoms and somatic symptoms, cognitions about mental incapacitation and depressive symptoms, and cognitions about social concerns and avoidance behavior. In addition, Rachman (1988) postulated that cognitions concerning physical fears (e.g., "death") would be related to avoidance of situations when unaccompanied. Based on these findings and theories, hypotheses were developed about the relationship between the ASI lower-order factors and PD.

H3: The ASI lower-order factors would be differentially related to specific aspects of PD, both with respect to total ASI and ASI lower-order factors.

H3a: The ASI lower-order factor concerning physical fears would be associated with the somatic symptom of sleep problems.

H3b: The ASI lower-order factor concerning physical fears would be associated with avoidance of situations when unaccompanied, but not associated with avoidance when accompanied or avoidance of situations.

H3c: The ASI lower-order factor concerning fears of cognitive catastrophes would be associated with symptoms of depression including suicidal ideation.

H3d: The ASI lower-order factor concerning social fears would be associated with avoidance behavior.

H3e: The ASI lower-order factor concerning social fears would be associated with social phobia.

1. Methods

1.1 Participants

The sample consisted of 131 patients with PD who volunteered for free assessment and outpatient treatment services at a university clinic. The mean age was 36 years and 67% were female. Their ethnic composition was 83.8% Caucasian, 9.2% African-American, 2.3% Hispanic and 4.8% other races. The treatment provided was a form of cognitive-behavioral group therapy (CBGT) that has been shown to be effective in helping a large majority (i.e., 75-80%) of patients with PD meet recovery criteria compared to 0% of a delayed treatment control group (Schmidt, Staab, Trakowski, & Sammons, 1997). The treatment primarily consisted of (1) psychoeducation about the cognitive behavioral model of panic, (2) training in cognitive reappraisal, (3) repeated exposure to bodily sensations associated with the fear response (i.e., interoceptive exposure), and (4) repeated exposure to external situations associated with the fear response (i.e., in vivo exposure).

The pre-treatment data on the expression of PD was available for 131 patients with PD and the post-treatment data representing the course of PD was available for 60 of these subjects. Independent t-tests were performed to examine whether there were any differences between the subjects who provided both pre and post treatment data and the subjects who only provided pretreatment data. The t-tests were used to test for potential differences in demographic characteristics, ASI total and sub-factor scores, and scores on any of the measures of PD expression and course. The only significant difference was the percent of Major Depression Diagnoses (MDD) in each group ($t(115) = 0.206$, $p = .042$). Of the group of subjects who provided both pre- and post treatment data, 11.1% were diagnosed with MDD, in comparison to 66.2% of the group of subjects who only provided pretreatment data. Since the PD treatment was not designed to treat MDD directly, the lack of post-treatment research participation for high number of subjects may have been associated with untreated depressive illness and symptoms. In addition, another possible reason for the low post treatment participation may have also been the lack of incentive to continue participating in the research once the treatment had been completed.

1.2 Expression and Course Variables

In order to investigate the relationship between AS and a comprehensive range of PD features, this study included features that were conceptualized as both primary and secondary to PD. Primary features were defined as features that are specific to the expression of PD. The primary features included panic attack frequency, general anxiety level, anticipatory anxiety, phobic avoidance, core fears, and the changes in these features

that represent the course of PD. In comparison, secondary features were defined as aspects of PD that are not specific to the expression of PD. The secondary features included co-occurring axis I symptomatology such as social phobia, depression, suicidal ideation, concentration problems, sleep problems, general impairment, and treatment outcome. The selection of primary and secondary features was consistent with recommendations from the National Institutes of Health Consensus Development Conference on the Treatment of Panic Disorder of those clinical features that should be measured for a full characterization of PD (Shear & Maser, 1994).

1.3 Measures

Both clinician-rated and self-report measures were used to measure the various aspects of panic disorder expression and course. The clinician-rated measures included Structured Clinical Interview for DSM-IV axis I disorders (SCID), Panic Disorder Severity Scale (PDSS), and Clinical Global Impressions (CGI). The self-report measures comprised the Anxiety Sensitivity Inventory (ASI), Beck Anxiety Inventory (BAI), Beck Depression Inventory (BDI), Panic Appraisal Inventory (PAI), Mobility Inventory (MI), Sheehan Disability Scale (SDS), and Medical History (MH) form.

1.3.1 Structured Clinical Interview for DSM-IV axis I disorders (SCID)

The Structured Clinical Interview for DSM-IV axis I disorders (SCID; First, Spitzer, Gibbon, & Williams, 1997) is designed to address important diagnostic information and facilitate reliable diagnoses. Interviewers who had extensive training in administering and scoring the SCID conducted the interviews. The validity of diagnoses was evaluated

by weekly reviews by the senior author and random reviews of videotaped interviews comparing inter-rater reliability of diagnoses, which yielded acceptable kappa coefficients (Schmidt et al., 1997).

2.3.2 Panic Disorder Severity Scale (PDSS)

The panic disorder severity scale (PDSS; Shear et al., 1997) is a brief clinician rating scale used to assess seven key dimensions of PD. These dimensions include panic frequency, panic distress, anticipatory anxiety, phobic avoidance of situations, phobic avoidance of sensations, impairment in work functioning, and impairment in social functioning. The clinician rates the severity of each feature on a five-point scale ranging from 0 ("none") to 4, where higher numbers indicate increasing severity of that feature. For each feature, the ratings 1-4 are also anchored by specific descriptors of what is meant by a given level of severity. A multicenter collaborative study found that the PDSS, when administered by trained raters, was associated with strong interrater reliability (0.87) and moderate internal consistency (0.65) as well as adequate validity and sensitivity to change (Shear et al., 1997).

2.3.3 Clinical Global Impressions (CGI)

The Clinical Global Impressions Scale Severity of Illness Rating and Improvement Rating (CGI; Guy, 1976) is a 7-point clinician rating system of overall panic disorder severity and global improvement.

2.3.4 Anxiety Sensitivity Index (ASI)

The Anxiety Sensitivity Index (ASI; Reiss, Peterson, Gursky, & McNally, 1986) is a well-researched self-report measure of the dispositional model of AS. The ASI has 16 items that assess the fear of anxiety-related symptoms and a concern about negative meaning of symptoms or that symptoms will result in negative consequences (see appendix A). The reliability reports vary from acceptable to strong correlations for a 2 week interval (r = 0.75; Reiss et al., 1986), 3-year period (r = .71; Maller and Reiss, 1992) and split-half reliability (r = 0.85; Peterson and Heilbronner, 1987).

The ASI dimensions defined by Zinbarg, Barlow, and Brown's (1997) confirmatory factor analysis were selected in order to provide standardization with other research efforts. These factors have been found to be generally consistent across clinical and non-clinical populations and across genders (Stewart et al., 1997; Zinbarg et al., 1997). The factors were organized as fears of catastrophes pertaining to physical harm (e.g., heart attack), cognitive harm (e.g., going crazy), and social judgment (see appendix B). The physical harm factor is defined by eight items (3, 4, 6, 8, 9, 10, 11, 14), the cognitive harm factor consists of four items (2, 12, 15, 16) and the social judgment factor is also made up of four items (1, 5, 7, 13).

2.3.5 Beck Anxiety Inventory (BAI)

The Beck Anxiety Index (BAI; Beck, Epstein, Brown, & Steer, 1988) was used to assess general anxiety symptoms. The BAI is a 21 item self-report questionnaire for measuring the severity of anxiety. The BAI was specifically developed to discriminate anxiety from depression and is reported not to overlap with content measures of depression. BAI scores have been shown to be moderately correlated with the Hamilton

Anxiety Rating Scale scores, r(150)=.51 and only mildly correlated with the revised Hamilton Depression Rating Scale, r(153)=.25 (Beck et al., 1988). In addition, the BAI has displayed high internal consistency (alpha = .93) (Cox et al., 1996).

2.3.6 Beck Depression Inventory (BDI)

The Beck Depression Inventory (Beck et al., 1979) is a widely used self-report measure of depression severity that has strong psychometric properties (Beck, Steer, & Garbin, 1988) and is sensitive to changes in clinical status (Edwards et al., 1984).

2.3.7 Panic Appraisal Inventory (PAI)

The Panic Appraisal Inventory (PAI; Telch, Brouillard, Telch, Agras, & Taylor, 1989) has three subscales measuring perceptions and beliefs involving the (1) likelihood of panic across a variety of situations, (2) consequences of having a panic attack (e.g. heart attack, loss of control), and (3) ability to cope with a full-symptom panic attack across situations. The consequences subscale is further divided into three factor-analytically derived subscales representing fears involving either social, physical, or loss of control concerns. Telch and colleagues (1989) reported that the consequences of panic subscale and its subscales had a high test-retest reliability (r = .86) and high internal consistency (α = .91).

The PAI consequences of panic subscales provide potentially important information for the conceptualization and treatment of PD. Identifying the general nature of a patient's fear as social, physical, or loss of control will help to determine the patient's "core threat". Understanding the core threat is a fundamental component of cognitive

behavioral therapy (CBT) because core threats are presumed to be a central feature of what maintains PD. Likewise, core threats represent the organizing factor behind the combination of cognitive, behavioral, and physiological CBT interventions for PD such as thought records, behavioral experiments, and interoceptive exposure exercises. For purposes of this study, identification of core threats as measured by the PAI will be compared to the ASI subscales that are conceptualized as measuring similar fears.

2.3.8 Mobility Inventory (MI)

The Mobility Inventory for Agoraphobia (MI; Chambless, Caputo, Jasin, Gracely, & Williams, 1985) is a self-report scale that assesses phobic avoidance across various settings and situations with and without a companion. The MI has been validated with clinical and non-clinical samples (Jacobson, Wilson, & Tupper, 1988; Arrindell, Cox, Van der Ende, & Kwee, 1995).

2.3.9 Sheehan Disability Scale (SDS)

The Sheehan Disability Scale (SDS; Sheehan, 1983) is a self-report measure of impairment associated with a clinical problem. The SDS aggregates scores from three subscales measuring the level of disability associated with work, family, and social functioning over the past month. The SDS has been found to have acceptable reliability and construct validity with patients who have panic disorder (Leon, Shear, Portera, & Klerman, 1992).

2.3.10 Medical History (MH) form

The medical history (MH) is a self-report measure of previous and current medical and psychiatric assessment procedures, diagnoses and treatments including medications.

2.4 *Data Analyses*

Pearson correlations were computed among the ASI total and sub-factor scores and each variable representing the expression and course of PD. An alpha level of .01 was used as a conservative criterion for all statistical tests. However, a more stringent criterion (e.g., Bonferroni correction) was not used because of the exploratory nature of the study. The strength of the correlations are characterized on the basis of Cohen and Cohen's (1983) criteria of small, medium, and large effect sizes as roughly equivalent to r = .10, .30, and .50, respectively. The treatment change scores for the ASI and PD features were calculated as residualized change scores.

3 **Results**

3. 1 *ASI and All Features of PD*

The first main hypothesis (H1) was that the ASI total score would be associated with all features of PD. This hypothesis was divided into two sub-hypotheses pertaining to the expression and course of PD.

The first sub-hypotheses (H1a) predicted a relationship between ASI and variables representing the expression of the PD disorder. This sub-hypothesis was generally supported because the ASI scale had moderate to strong relationships with all PD expression variables except self-reported work and social impairment (see table 1).

Moreover, the ASI had its strongest relationships ($r > .50$) with the BAI measure of general anxiety and with two of the core fear scales from the PAI.

Insert Table 1 about here

The second sub-hypotheses (H1b) predicted a relationship between ASI and variables representing the course of the PD disorder. This sub-hypothesis was also generally supported except for the relationship between ASI and the clinician-rating of severity of illness (see table 2).

Insert Table 2 about here

3.2 *ASI Lower-Order Factors and Measures of Similar Constructs*

The second main hypothesis (H2) was that the three lower-order factors of the ASI would be associated with measures of other constructs representing similar fearful cognitions. Constructs of similar core fears were measured by the components from the consequences of panic subscale in the PAI. There were strong relationships (correlations ranging from .50 to .64) between each ASI dimension and measures of related core fears (see table 3).

Insert Table 3 about here

3.3 *ASI Lower-Order Factors and Specific Features of PD*

The final main hypothesis was that the ASI total and lower-order factors would be differentially related to specific aspects of PD. The pattern of differential relationships between ASI lower-order factors and PD features was evident in the significant number of ASI lower-order factors related to specific PD features and the magnitude of these relationships (see tables 1 and 2).

The ASI lower-order factors had varying relationships with each variable representing the expression and course of PD. Only three variables representing the expression and course of PD (general anxiety and the core fears of loss-of-control and social catastrophe) were correlated with all three ASI lower-order factors. The majority of PD variables had correlations with only two of the three ASI dimensions and six PD variables had a significant correlation with only a single ASI lower-order factor.

The magnitude of the relationships between ASI lower-order factors and each PD variable also suggested specificity between certain ASI lower-order factors and PD variables. For the majority of the discrete PD features, the relationship between the PD feature was stronger with an ASI lower-order factor than with the ASI total score. In addition, the relationships between ASI lower-order factors and certain PD features were also found between the same ASI lower-order factors and PD features that could be categorized in a similar grouping (e.g., the ASI lower-order factor representing cognitive concerns was related to several depressive features).

In addition to expecting a general pattern of differential relationships between ASI lower-order factors and PD features, relationships between specific ASI lower-order factors and PD features were also hypothesized. Four sub-hypotheses were generated, based on theoretical premises and empirical data from the literature that suggested relationships between specific ASI lower-order factors and features of PD. In addition, the relationships between ASI lower-order factors and other features of PD were explored.

The first sub-hypothesis (H3a) was that the ASI lower-order factor concerning physical fears would be associated with the somatic symptom of sleep problems. This

hypothesis was not supported by the data. In fact, the ASI physical fears lower-order factor was the only ASI lower-order factor not to be associated with sleep problems.

The second sub-hypothesis (H3b) was that the ASI lower-order factor concerning physical fears would be associated with avoidance of situations when unaccompanied, but not associated with avoidance when accompanied or avoidance of situations. The data partially supported this hypothesis. The ASI lower-order factor of physical fears was related to Avoidance when unaccompanied (e.g., alone) and avoidance when accompanied (e.g., not alone), but not avoidance of situations. In addition, the magnitude of the correlation between the ASI lower-order factor of physical fears and Avoidance when unaccompanied (moderate effect size) was larger than the correlation between the ASI lower-order factor of physical fears and Avoidance when accompanied (small effect size).

The third sub-hypothesis (H3c) was that the ASI lower-order factor concerning fears of cognitive catastrophes would be associated with symptoms of depression including suicidal ideation. This hypothesis was supported by the data. The cognitive-harm dimension demonstrated strong associations with measures of depression and suicidal ideation.

The fourth sub-hypothesis (H3d) was that the ASI lower-order factor concerning social fears would be associated with avoidance behavior. This hypothesis was not supported for the relationship between the social-harm lower order factor and four different types of avoidance.

The fifth sub-hypothesis (H3e) was that the ASI lower-order factor concerning social fears would be associated with social phobia. This hypothesis was clearly supported

because only social-harm lower-order factor showed a significant relationship with a social phobia diagnosis.

The results of the analyses also indicated several other significant relationships between the ASI lower-order factors and specific aspects of PD expression and course. First, the physical-harm factor was associated with general anxiety, general depression, and avoidance of sensations. In addition, the physical-harm change score was strongly correlated with treatment outcome change scores, frequently showing stronger correlations than the ASI. On the other hand, the cognitive-harm dimension showed consistently strong relations with the pre-treatment levels of primary features.

In addition to finding that cognitive concerns demonstrated the highest correlations with depressive features, the other two ASI lower-order factors also demonstrated fairly consistent relations with the different depressive features. The social concerns factor was also related to the majority of depression features. In comparison, the physical concerns factor was only related to the measure of general depression (e.g., BDI scores) and the treatment change score in depression (e.g, residualized change score in BDI scores).

The relationship of the ASI total and cognitive concern factor scores with two neurovegative symptoms associated with depression (concentration and sleep problems) opened up the possibility that these relationships were a function of the relationship between ASI and depression. Therefore, post hoc partial correlation analyses were used to examine the relationship between ASI total score, cognitive concerns lower-order factor, and these neurovegetative symptoms while controlling for depression (e.g., BDI score). With the level of depression controlled, the relationship between ASI total score and the neurovegetative symptoms was not significant. However, the relationship

between the cognitive concerns lower-order factor and the neurovegetative symptoms approached significance.

Insert Table 4 about here

4 Discussion

Overall, this study has three major findings. First, AS was related with a broad range of PD features, supporting the existence of a pathoplastic relationship between AS and PD. Second, changes in AS following treatment correspond to changes in PD, suggesting the importance of AS in treatment success. Lastly, AS lower-level factors possess specificity with respect to predicting certain aspects of PD course and expression.

The ASI total score showed moderate to strong correlations with nearly all of the primary and secondary features of PD including treatment outcome data. The magnitude of the correlations indicate that the ASI's pathoplasty relationship with PD is empirically significant and suggests the potential for clinical significance as well. Furthermore, the range of PD features that were related to AS also suggests the clinical importance of AS

In addition to the findings with the ASI total score, the three ASI lower-order factors demonstrated moderate to strong correlations with different aspects of PD expression and course. Moreover, the correlations between ASI lower-order factors and PD features were often equal to or greater in magnitude than the relationship between the ASI total score and the same PD features.

Several hypotheses about relationships between certain ASI lower-level factors and PD features were supported, suggesting that the ASI lower-level factors may provide a deeper level of understanding of how AS relates to PD features. For instance, the lower-level ASI factors demonstrated a consistent pattern of relations with depressive features.

The depressive features were related to the ASI lower-level factors pertaining to cognitive and social concerns but not physical concerns. These systematic findings may indicate the relative importance of these factors in the maintenance and treatment of depressive symptoms. It is also important to note that when depression was statistically controlled, the cognitive concerns ASI factor also demonstrated relationships with two neurovegetative features (e.g., concentration and sleep problems) associated with depression. These results provide grounds for future research about the role of cognitive concerns in relation to co-occurring depression and features associated with depression.

The unexpected findings also provide questions for future research. Avoidance is a common feature of PD that can take several forms: avoidance of situations and sensations when accompanied or unaccompanied. The hypothesized relationship between the social concerns lower-order factor and avoidance were not supported for any of the four forms of avoidance that were measured. A possible explanation is that the avoidance associated with PD is more oriented towards avoiding situations that might precipitate a panic attack or not allow adequate protection in the event of a panic attack. As suggested by this study's data, PD avoidance is more likely to be associated with fears of physical or cognitive catastrophe than social catastrophes.

Fears of social catastrophes are more likely to be associated with avoidance of social situations. Avoidance of social situations was not measured directly because this type of avoidance is conceptually related to social-evaluative fears and, therefore, more likely to be associated with social phobia. In fact, the social concerns lower-level factor was the only lower-level factor to be associated with social phobia.

Logical discrepancies between observed relationships between some ASI lower-order factors and PD features also suggest directions for future research. The cognitive lower-level factor of the ASI appeared to have the strongest and, in many cases, exclusive relationships with many features of PD expression. However, the ASI physical lower-level factor had the strongest associations with several of the same PD features over the course of treatment. CBGT treatment does not appear to have had a differential effect on ASI lower-order factors because each of the ASI lower-order factors decreased significantly over the course of treatment. However, the possibility of the ASI lower-order factors regressing to the mean over time can not be ruled out because of the lack of a control group.

The qualitative differences between the physical and cognitive ASI lower-order factors may provide some direction for future research about why different ASI lower-order factors have dominant relationships with different groups of PD variables (i.e., physical concerns and treatment changes; cognitive concerns and depressive symptoms). A primary difference between the ASI physical and cognitive lower-level factors is the nature of attributions for each factor. The physical concerns are about a potential medical problem (e.g., heart attack) whereas the cognitive concerns focus on mental catastrophes (e.g., losing control and going crazy).

However, the belief structures of the physical and cognitive concerns may also represent an implicit belief in the dualism of body and mind. The physical concerns may be limited to physical symptoms and health consequences whereas the mental concerns may be primarily about mental symptoms and health consequences. Moreover, it is conceivable that cognitive concerns are attributed to mental defects and associated with

negative self-evaluative beliefs such as being fundamentally incompetent. In contrast, the beliefs associated with physical concerns are more likely to concern problems with a person's body and less likely to be attributed to personal identity issues. The potential relationship between negative self-evaluative beliefs and cognitive concerns could contribute to the relationship between cognitive concerns and depressive symptoms because negative self-evaluation is a key cognitive component of depression.

The physical and cognitive concerns may have different responses to CBGT. Since both physical and cognitive concerns negatively reinforce avoidance behaviors, a large part of the treatment protocol involves cognitive and behavioral experiments (cognitive restructuring and exposure) to test and extinguish these fears. However the symptoms (e.g. heart beats rapidly, feel faint) that are associated with physical concerns are more overt than the symptoms (e.g., inability to keep mind on task) associated with cognitive concerns. Therefore, the symptoms associated with physical concerns may be more amenable to operationalization and testing in therapy because the symptoms can be easily generated using standard exercises (e.g., breathing through a straw for a set period of time to simulate hyperventilation symptoms). On the other hand, the symptoms associated with cognitive symptoms may be more difficult to recreate and test for therapeutic purposes such as exposure exercises or cognitive restructuring. However, it is important to reiterate that this study's data did not find that CBGT had an equivalent effect on changes in levels of physical concerns and cognitive concerns as measured by the ASI factors.

Several limitations of this study are important to note and address in future studies. Zinbarg (1998) emphasized the need for a multitrait-multimethod-multisystem approach

for research concerning hierarchical constructs and lower-level responses that are partially distinct across different systems. This study examined a comprehensive range of variables representing the expression and course of PD, providing a multitrait and multisystem (e.g., biopsychosocial) perspective. However, the measurement of the PD features was often limited to a single method (e.g., self report) type of assessment.

Despite the use of both patient self-report and clinician ratings, there was little overlap of different types of measures for the same PD variable. An incorporation of different types of measures for the same variable would have provided a way to control for the potential confounding effects of using the same assessment methodology. Follow-up studies of findings should use multimethod measures of the same PD feature.

A noteworthy exception to the lack of overlapping assessment methods was the use of both clinical interviews and self-report instruments to measure depressive symptomatology. In this case, the multiple methods provided additional support for patterns of relationships and suggested a methodological issue with the one inconsistency. In general, the result was a consistent relationship between the PD variables and the cognitive and social, but not the physical ASI lower-order factors. Interestingly, the only inconsistent relationship between ASI lower-order factors and depressive symptoms was the SCID measure of suicidality, which may have been due to method variance. During the SCID, a subject is not asked about suicidality unless the subject initially endorses depressed mood or loss of interest for at least a two-week period.

One way to better measure suicidality would be to use a psychiatric interview that assesses suicidality separately and more thoroughly, such as the Mini-International

Neuropsychiatric Interview (M.I.N.I., Sheehan et al., 1998). The M.I.N.I. includes an independent suicidality assessment module that inquires about suicidal thoughts, desires, plans, and attempts as well as previous suicidal behavior. The data from these questions are compiled to determine if the patient has no, low, moderate, or high suicide risk.

Another limitation was the measurement of physiological features. A more accurate and complete multisystem assessment of biopsychosocial features of PD would have included direct measures of the physiological system. The study's data about physiological responses came from aggregate self-report measures such as the BAI. More direct measures, such as physiological responses to panicogenic challenges (e.g., heart rate changes in response to carbon dioxide inhalation), would have provided valuable objective measures of physiological symptoms. Moreover, the standardization of a lab challenge would have also provided more comparable base rate and response data..

The study was also limited with respect to measuring the full course of PD. The representation of PD course was limited to measures immediately following treatment, not long-term follow up measures. Long-term treatment outcome is important because, despite the short-term treatment success of CBT, the follow-up measures in one study revealed that 30% of patients did not meet criteria for high-end functioning because of panic symptoms. Therefore, future studies should attempt to include a long-term follow up measure of PD variables.

Additional time points would also be valuable in examining the interaction between PD variables and ASI. According to the formal axioms of cognitive theory, the influences between cognitive systems and other systems are expected to be interactive

(Alford & Beck, 1997). More complex bi-directional relationships may be possible between PD variables and ASI before, during and after therapy.

A final consideration is that the small number of ASI items may not provide enough items to reveal the full number and type of lower-order factors. To address this limitation, Taylor and Cox (1998) created a 60-item instrument to measure AS, the Anxiety Sensitivity Profile. The authors administered the larger AS inventory with a large non-clinical sample and found four lower-order factors corresponding to fear of (1) respiratory symptoms, (2) cognitive dyscontrol, (3) gastrointestinal symptoms, (4) cardiac symptoms. If these results are replicated with a sample of patients with PD, the studies using the ASI could provide hypotheses for research using the new instrument. In addition, research using the ASI lower-order factors still offers the practical advantages of being a popular measure that is easily administered, frequently used, and already has large amounts of empirical support with clinical populations that can be re-investigated with respect to the ASI lower-order factors..

The study of pathoplastic relationships between ASI dimensions and PD expression offers several potential benefits such as improved understanding of PD maintenance and course, identification of PD patient subtypes, and improved ability to treat and form prognoses. The ASI and the dimensions of the ASI appear to have moderate to strong relationships with specific, but not all, aspects of the expression and course of PD. The selective relationships between AS and PD may indicate that there are causal mechanisms that are partly determined or reflected by the level and distribution of ASI scores. Moreover, elevated ASI scores or dimensional score profiles may represent subtypes of PD patients that present with unique symptoms, respond differently to standard treatment

protocols, and may benefit from treatment that is tailored to their ASI score. At a minimum, a panic patient's ASI lower-order factor profile may help identify the cognitions (Rachman, 1993) that are central to the maintenance of a given patient's expression and course of PD and a tailored treatment protocol.

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APPENDIX A

Anxiety Sensitivity Inventory

Rate the following items to the extent you agree with each:

Very little (0)
A little (1)
Some (2)
Much (3)
Very Much (4)

1. It is important to me not to appear nervous.
2. When I cannot keep my mind on task, I worry I might be going crazy
3. It scares me when I feel 'shaky" (trembling).
4. It scares me when I feel faint.
5. It is important to me to stay in control of my emotions.
6. It scares me when my heart beats rapidly.
7. It embarrasses me when my stomach growls.
8. It scares me when I am nauseous.
9. When I notice that my heart is beating rapidly, I worry that I might have a heart attack.
10. It scares me when I become short of breath.
11. When my stomach is upset, I worry that I might be seriously ill.
12. It scares me when I am unable to keep my mind on a task.
13. Other people notice when I feel shaky.
14. Unusual body sensations scare me.
15. When I am nervous, I worry that I might be mentally ill.
16. It scares me when I am nervous.

APPENDIX B

ASI Factors

Factor One: Fear of Sensations (physical catastrophe)

- It scares me when I feel 'shaky" (trembling). (3)
- It scares me when I feel faint. (4)
- It scares me when my heart beats rapidly. (6)
- It scares me when I am nauseous. (8)
- When I notice that my heart is beating rapidly, I worry that I might have a heart attack. (9)
- It scares me when I become short of breath. (10)
- When my stomach is upset, I worry that I might be seriously ill. (11)
- Unusual body sensations scare me. (14)

Factor Two: Fear of going Crazy (mental catastrophe)

- When I cannot keep my mind on task, I worry I might be going crazy (2)
- It scares me when I am unable to keep my mind on a task. (12)
- When I am nervous, I worry that I might be mentally ill. (15)
- It scares me when I am nervous. (16)

Factor Three: Fear of Embarrassment (social catastrophe)

- It is important to me not to appear nervous. (1)
- It is important to me to stay in control of my emotions. (5)
- It embarrasses me when my stomach growls. (7)
- Other people notice when I feel shaky. (13)

APPENDIX C

Table 1

ASI Correlations with Primary and Secondary PD Features

Primary features of PD (measure)	ASI Total	Factor 1: Physical Concerns	Factor 2: Cognitive Concerns	Factor 3: Social Concerns
Panic Attack Frequency (PDSS)	.36		**.41**	.36
General Anxiety (BAI)	**.53**	.51	.40	.28
Anticipatory Anxiety (PDSS)	.28		**.41**	.24
Avoidance of Situations (PDSS)	.24		**.33**	
Avoidance of Sensations (PDSS)	.27	**.29**	.27	
Avoidance, Accompanied (MI)	.29	.24	**.33**	
Avoidance, Alone (MI)	**.39**	.36	.34	
Severity of Illness (CGI)	**.28**			
Co-occurring secondary features of PD (measure)	**ASI Total**	**Factor 1: Physical Concerns**	**Factor 2: Cognitive Concerns**	**Factor 3: Social Concerns**
Concentration Problems (MH)	.23		**.33**	
Sleep Problems (MH)	.29		**.33**	.24
Work Impairment (PDSS)	.35		**.43**	.27
Social Impairment (PDSS)	**.27**		.24	.24
Work & Social impairment (SDS)			**.32**	
Depression Diagnosis (SCID)	.36		**.40**	.32
General Depression (BDI)	.45	.30	**.47**	.36
Suicidal Ideation (BDI)	.37		**.41**	.26
Suicidal Ideation (MH)	.39		**.42**	.35
Suicidal Ideation (SCID)	**.25**			
Social Phobia (SCID)				**.27**

Note. Only correlations $p < .01$ displayed.

The highest correlation for each feature of PD is in bold text.

Correlations are between residualized change scores.

Table 2

ASI Change Score Correlations with Treatment Change Scores

PD variable (measure)	ASI Total	Factor 1: Physical Concerns	Factor 2: Cognitive Concerns	Factor 3: Social Concerns
General Anxiety (BAI)	.53	**.58**		.43
Panic Attack Frequency (PDSS)	.39	**.50**		
Anticipatory Anxiety (PDSS)	.40	.40	**.53**	
Avoidance, Accompanied (MI)	**.42**	**.42**		.39
Avoidance, Alone (MI)	.55	**.62**	.34	
Work & Social Impairment (SDS)	**.51**	.50		.47
Depression (BDI)	**.37**	**.37**		
Severity of Illness (CGI)		**.42**		

Note. Only correlations $p < .01$ displayed.

The highest correlation for each feature of PD is in bold text.

Correlations are between residualized change scores.

Table 3

ASI Correlations with PD Core Threats

PD variable (measure)	ASI Total	Factor 1: Physical Concerns	Factor 2: Cognitive Concerns	Factor 3: Social Concerns
Physical Fears (PAI)	.55	**.67**	.34	
Loss-of-Control Fears (PAI)	.53	.37	**.62**	.31
Social Fears (PAI)	.48	.29	.48	**.50**

Note. Only correlations $p < .01$ displayed.

The highest correlation for each feature of PD is in bold text.

Table 4

ASI Partial Correlations with Neurovegetative Symptoms, Controlling for Depression

Neurovegetative symptoms (measure)	ASI Total	Factor 2: Cognitive Concerns
Concentration Problems (MH)	N.S.	.21 ($p = .021$)
Sleep Problems (MH)	N.S.	.22 ($p = .012$)

Note. N.S. = nonsignificant.