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Alexithymia and Anxiety Sensitivity in Patients with Non-Cardiac Chest Pain

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Abstract

The aim of this study was to examine independent and combined influences of alexithymia and anxiety sensitivity on chest pain and life interference in patients with non-cardiac chest pain (NCCP). Theories of NCCP posit a central role for emotion in the experience of chest pain, however, studies have not examined how alexithymia characterized by a difficulty identifying or verbalizing emotions, may influence this relationship. This study examined 231 patients (56% female, *M* age = 50 years) with chest pain seeking cardiac evaluation who showed no abnormalities during exercise tolerance testing. Forty percent (40%) scored at or above the Moderate range of alexithymia. Whereas health care utilization was associated with elevated alexithymia among men, health care utilization was associated with elevated anxiety sensitivity among women. Hierarchical regression analyses revealed that alexithymia and anxiety sensitivity were both uniquely and independently associated with pain severity and life interference due to pain. Alexithymia-pain links were stronger for men compared to women. Secondary analyses conducted with a subsample suggest that alexithymia may be increasingly stable over time (i.e., 18 month follow-up). Findings are largely congruent with theoretical models of NCCP showing that personality and emotional factors are important in this medically unexplained syndrome.

Keywords

Non-cardiac chest pain; chest pain; alexithymia; anxiety sensitivity; personality; pain; anxiety; medical unexplained symptoms

1. Introduction

Chest pain is one of the most common medical complaints. Since it may be a warning sign of coronary artery disease or myocardial infarction, it is also one of the most frightening

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pains. More than half of patients referred for coronary angiography suffer chest pain that is not cardiac in origin (Papanicolau et al., 1986), and many chest pain patients do not receive a medical explanation for their pain (Kroenke & Mangelsdorff, 1989; Mayou, Bryant, Forfar, & Clark, 1994). Non-cardiac chest pain (NCCP) is the experience of angina-like chest discomfort in the absence of coronary artery disease or other apparent cardiac etiology – sometimes regarded as the sensitive heart because of the abnormal cardiac pain perception in this pain population (Cannon, 2009), for review (White, 2007). With few exceptions (Bodegard, Erikssen, Bjornholt, Thelle, & Erikssen, 2004; Eslick & Talley, 2008), the prognoses of patients with NCCP following a normal coronary angiography have a better prognosis than patients with coronary artery disease (CAD) (Lichtlen, Bargheer, & Wenzlaff, 1995; Papanicolaou et al., 1986). Despite this prognosis, the syndrome of NCCP is associated with impaired psychosocial functioning, reduced quality of life (Mayou, 1998), and discomfort and disability comparable to patients with CAD (Eifert, Hodson, Tracey, Seville, & Gunsawardane, 1996). Many patients experience worry, anxious preoccupation with heart functioning, and recurrent chest pain (Esler & Bock, 2004; White & Raffa, 2004) that results in increased health care costs due to repeat hospitalizations, emergency department visits, and cardiac catheterizations (Johnson et al., 2004; Ockene, Shay, Alpert, Weiner, & Dalen, 1980).

Early conceptualizations of cardiophobia characterized this syndrome by fears of heart attack and death, suggesting that NCCP patients may focus attention on their heart when experiencing stress and arousal (Eifert, 1992). Modern theoretical models of NCCP are multicausal (Eifert, Zvolensky, & Lejuez, 2000; Mayou, 1998) and underscore the multidisciplinary nature of the problem (White & Raffa, 2004). Because emotional disorders often co-occur with NCCP (White et al., 2008), especially anxiety disorders, empirically-supported models of anxiety disorders have been shown to be relevant for patients with NCCP (White & Barlow, 2002). One model that has foundations in empirically-supported models of panic disorder (White & Barlow, 2002) draws upon Eifert's early cardiophobia work, and emphasizes the importance of biological vulnerability, stress, and psychological vulnerability leading to anxious apprehension and learned alarm (White & Raffa, 2004). This theoretical model is supported by research showing that psychological factors which affect the cognitive interpretation of bodily sensations are an important component of NCCP etiology (Mayou, 1998). One of these factors is anxiety sensitivity, the trait tendency to fear anxiety-related physiological sensations based on the belief that they signal impending harm (Reiss, 1991). Anxiety sensitivity is considered a psychological vulnerability to developing anxiety symptoms, including chest pain (Lipsitz et al., 2004). NCCP patients are thought to develop hypersensitivity to benign physical sensations that they perceive as indications of catastrophic danger, specifically a heart attack (Esler & Bock, 2004). Indeed, research demonstrates that these patients fear heart-related sensations as much as heart disease inpatients, and that this fear is associated with the intensity of cardiac complaints, including chest pain (Aikens, Michael, Levin, & Lowry, 1999; Eifert et al., 1996; Lipsitz et al., 2004). The syndrome of NCCP is thought to persist partly due to conscious hypervigilance to physical sensations (White, Craft, & Gervino, 2010), and anxiety sensitivity may also account for some of the high healthcare utilization by NCCP patients. Research suggests that worry about and monitoring of physical symptoms may have a greater impact than the nature of the physical symptom on the decision to go to a hospital emergency department (Wulsin & Yingling, 1991). In fact, in a survey of NCCP patients, worry over chest pain was the most commonly reported reason for seeking medical attention (Eslick & Talley, 2004).

Another psychological vulnerability factor that may be significant for patients with NCCP is alexithymia. Alexithymia - literally "no words for feelings" - is a personality construct characterized by deficits in the cognitive processing and regulation of emotions (Sifneos, 1973; Spitzer, Siebel-Jurges, Barnow, Grabe, & Freyberger, 2005). The idea that

alexithymia might influence physical complaints is tied to the knowledge that physiological alterations accompany affective arousal. Individuals with alexithymia have difficulty identifying emotions and may be unaware of this relationship between affect and physiological alterations. Consequently, they may experience these alterations not as emotional experiences, but as undifferentiated, uncomfortable, and confusing physical sensations (Kooiman, Bolk, Brand, Trijsburg, & Rooijimans, 2000; Lumley, Stattner, & Wehmer, 1996). These physical sensations are often misinterpreted and reported as symptoms of a physical illness (Taylor, Bagby, & Parker, 1991). A tendency to misinterpret emotional arousal may make individuals with alexithymia more likely to be present with NCCP, since they may experience and report physiological emotional symptoms (e.g., chest tightness) as signs of a physical heart problem. Indeed, in the only published study reporting alexithymia prevalence in a NCCP population, a small patient sample demonstrated moderately high levels of alexithymia that were greater than cardiac patients with chest pain (Lumley, Tomakowsky, & Torosian, 1997). In samples with medically unexplained physical symptoms and chronic pain patients, alexithymia scores were comparable to those of normal populations (Kooiman, Bolk, Rooijmans, & Trijsburg, 2004; Kosturek, Gregory, Sousou, & Trief, 1998). Moreover, people who score high on measures of alexithymia may be more at risk for experiencing future psychological problems (Spitzer et al., 2005).

Anxiety sensitivity and alexithymia both share a focus on physical sensations. For instance, whereas anxiety sensitivity is associated with a tendency to concentrate on physical sensations because of their feared consequences (Reiss & McNally, 1985), alexithymia is associated with a tendency to concentrate on the physical sensations associated with emotional arousal (Bagby & Taylor, 1997a). In both cases, the individual may mistake the physical sensations as signs of a medical problem or physical illness. Despite a similar and shared focus, research has shown that that they tap into related by differing aspects of concern about physical sensations. For instance, Mueller and Alpers (2006) demonstrated the independence of the constructs of anxiety sensitivity and alexithymia via common factor analysis as assessed by gold standard self-report measures (i.e., Anxiety Sensitivity Index and Toronto Alexithymia Scale) with minimal item overlap (Mueller & Alpers, 2006). In Muellers & Alper's study conducted with patients diagnosed with psychosomatic disorders, broadly-defined, anxiety sensitivity and alexithymia were distinct, moderately correlated constructs. Another study conducted with chronic pain sample showed that anxiety sensitivity was correlated with alexithymia at high levels, but this association was not supported at low levels (Cox, Kuch, Parker, Shulman, & Evens, 1994). Others have confirmed a moderate correlation between anxiety sensitivity and alexithymia in psychiatric samples (Zeitlin; Zahradnik, et al., 2009; Simpson, et al., 2006) and undergraduate samples (Devine, Stewart, & Watt, 1999). It is important to examine the link between anxiety sensitivity and alexithymia in a NCCP sample of patients, as it remains unclear to what extent alexithymia and anxiety sensitivity are associated with the experience of chest pain and health care utilization. Unlike in any past samples characterized by bodily symptoms of a chronic nature (i.e., chronic pain, psychosomatic patients), alexithymia may particularly relevant for NCCP, characterized by chest pain, a bodily symptom not usually coupled with an emotional cause.

Alexithymia has been conceptualized as a stable personality trait that predisposes individuals to psychiatric disorders (Devine et al., 1999; Nemiah, 1996; Spitzer et al., 2005), however, the exact nature of this construct is a matter of continuing debate (Taylor & Bagby, 2004). Some have characterized alexithymia as a reaction to unpleasant emotional states, in which individuals restrict or eliminate emotional range to mitigate painful affect (Ahrens & Deffner, 1986). Others posit that alexithymia may function as both a personality trait, referred to as primary alexithymia, and a state reaction, referred to as secondary alexithymia (Marchesi, Fonto, Balista, Cimmino, & Maggini, 2005; Muftuoglu, Herken,

Demirci, Virit, & Neyal, 2004). Secondary alexithymia is conceptualized as a coping mechanism through which individuals avoid unpleasant affective states by severely restricting emotional range (Berthoz, Consoll, Perez-Diaz, & Jouvent, 1999). An important distinction between primary and secondary alexithymia is their stability over time, which is a basic theoretical assumption underlying any personality trait construct (De Gucht, Fontaine, & Fischler, 2004). Primary alexithymia, as a trait, is thought to remain stable across time and affective state. Secondary alexithymia may fluctuate across time, according to changes in emotional distress (Martínez-Sánchez, Ato-García, & Ortiz-Soria, 2003). Longitudinal studies show a mixed characterization of the stability of alexithymia. Whereas alexithymia is rather stable in the general population (Salminen, Saarrijarvi, Toikka, Kauhanen, & Aarela, 2006) it has been found to be state-dependent to some extent in clinical samples (Honkalampi et al., 2001; Keltikangas-Jarvinen, 1987). We are not aware of any published reports examining the stability of alexithymia in NCCP patients.

A subset of patients with NCCP consumes sizeable healthcare resources. As this utilization results in considerable medical costs and systems level impairment (Eslick, Jones, & Talley, 2003), it is important to understand the components of the NCCP syndrome that may account for high healthcare utilization rates. There is a paucity of research examining the impact of alexithymia on healthcare utilization among patients with NCCP. Limited evidence suggests that higher alexithymia scores are associated with increased medical treatment in general patient populations (Lumley & Norman, 1996). An increased tendency to report physical symptoms could partially account for increased utilization by individuals with high alexithymia. Such a tendency was demonstrated by a study in which individuals with higher alexithymia scores were more likely to report vasovagal symptoms after giving blood, even when there was no increase in actual medical symptoms (Byrne & Ditto, 2005). By extension, it may be that NCCP patients with high alexithymia are more likely to notice the physical symptoms associated with emotional arousal, and therefore, they may be more likely to seek medical evaluation of chest symptoms compared to individuals with low alexithymia.

Clinical research is needed on the relationship between anxiety sensitivity and alexithymia, and how these psychological vulnerability factors may bring about increased chest pain and health care utilization in patients with NCCP. The present study examined the unique and combined associations between anxiety sensitivity, alexithymia, chest pain, and health care utilization in a sample of patients with NCCP. We hypothesized that anxiety sensitivity and alexithymia would be associated with increased chest pain (i.e., frequency, severity, duration) and life interference. Research on functional syndromes suggests that anxiety sensitivity and alexithymia may serve as unique but related psychological vulnerability factors for recurrent pain in patients with NCCP. Building on past research that suggested a moderate association, this study extends this research to examine these associations in medical patients with the recurrent pain syndrome of NCCP, characterized by a tendency to attend to physical sensations. We expected a moderate correlation between anxiety sensitivity and alexithymia in this study. We hypothesized that anxiety sensitivity may be associated with secondary alexithymia, as fear of anxiety-related sensations may motivate use of emotional constriction as a coping mechanism (Stewart, Zvolensky, & Eifert, 2002). In addition, it was also hypothesized that patients who tend to have difficulty distinguishing emotional and bodily sensations (i.e., more alexithymic) and who tend to misinterpret anxiety symptoms as signs of physiological distress (i.e., more anxiety sensitive) may also be the most likely to utilize health care resources. This study also extends previous research by examining the theoretically meaningful links between the psychological vulnerability factors and their possible overlap associated with pain in NCCP. Finally, an exploratory aim of this study was to inspect the internal consistency and temporal stability of alexithymia

across a short time course (i.e., 6-, 12-, and 18-months) in a small subsample of NCCP patients.

2. Methods

2.1 Participants

Data are part of a prospective cohort study of 231 patients who took part in a larger study examining the clinical course and correlates of NCCP. All patients were seeking care for a chief complaint of chest pain at an urban academic medical center. Eligibility criteria included: a) At least 18 years of age, b) Chief complaint of chest discomfort or anginal equivalent, c) Complete cardiac evaluation including general physical exam and exercise tolerance test, d) Exercise tolerance testing indicated no abnormalities, and e) English language fluency. To augment generalizability, patients were excluded if they had a) current or lifetime cardiac diagnosis (e.g., CHD, myocardial infarction), or b) current or recent (last 6 months) uncontrolled severe medical or psychiatric illness. Two patients were excluded from the study for failure to meet inclusion criteria at a follow-up data point.

A final sample of 229 patients participated in this study. Gender distribution in this sample was nearly equal (56% women), and average age was 50 years (*SD* = 10.3, R = 27 to 78). The sample was predominantly Caucasian (83%), and 56% reported their marital status as married. Nearly all patients had a high school diploma or equivalent degree or greater (98%), and a small minority of this sample were unemployed (7%) or on disability (5%). Many patients reported their household income to be equal to or greater than $60,000 (56%), and 11% reported household income at or below $15,000.

2.2 Measures

2.2.1 Demographic and medical history—Demographic and medical history was assessed using a self-report questionnaire. Age, sex, race, marital status, and socioeconomic status were assessed as well as general medical history (e.g., personal and family history, current medication).

2.2.2 Alexithymia—Alexithymia was measured using the 20-item self-report Toronto Alexithymia Scale (TAS) (Bagby, Parker, & Taylor, 1994). All items are rated on a five-point Likert scale, with five negatively scored items. Factor analyses have confirmed three factor subscales representing: Difficulty Identifying Feelings (DIF; and distinguishing between feelings and somatic sensations), Difficulty Describing Feelings (DDF), and Externally Oriented Thinking (EOT) (De Gucht et al., 2004). The TAS-Total scale and the three subscales have demonstrated adequate reliability and validity in both clinical and nonclinical populations (Bagby et al., 1994). Reliability in this study was adequate for the main TAS scale (Cronbach's alpha = 0.85) and for two of the three subscales, DIF (α = 0.86), DDF (α = 0.75), and EOT (α = 0.62).

2.2.3 Anxiety Sensitivity—Anxiety sensitivity was measured using the 16-item Anxiety Sensitivity Index (ASI) self-report questionnaire that involves rating items on a 0–4 point scale (Peterson & Reiss, 1993). Ratings are summed to produce a Total score that ranges from 0–64, with higher scores indicating greater anxiety sensitivity. The scale is comprised of three lower order factors -- Physical Concerns (fears over physical concerns), Mental Concerns (concerns about mental incapacitation), and Social Concerns (fears over social concerns) – that are thought to load onto a higher order factor of anxiety sensitivity (Rodriguez, Bruce, Pagano, Spencer, & Keller, 2004). The ASI has adequate reliability and validity in clinical and nonclinical samples, and demonstrated adequate reliability in this

study for the Total Scale (Cronbach's alpha = 0.91) and two of the three subscales: Physical (0.89), Mental (0.83), and Social Concerns (0.54).

2.2.4 Chest pain—The Multidimensional Pain Inventory (MPI) (Kerns, Turk, & Rudy, 1985) is one of the most widely used measures of pain. Studies have confirmed the adequacy of its psychometric properties (Thompson, 1990). This study examined MPI-Pain Severity (perceived pain intensity), and 2) MPI-Pain Interference (i.e., the impact of pain on different aspects of patients' lives). All items are rated on a 7-point Likert scale. Cronbach's alpha for the Pain Interference scale was 0.94. Cronbach's alpha for the MPI-Pain Severity scale was 0.66 and in the unacceptable range and an item analyses indicated that the scale did not appear to tap the construct of chest pain. To ensure the assessment tapped into chest pain specific domains, and to improve the reliability of the chest pain severity index, a Chest Pain Index score was computed that included the pain items from the MPI and items from the chest pain history questionnaire (Cronbach's alpha = 0.73). Chest pain was rated on Likert-type scales assessing the frequency, intensity, duration, and quality of chest pain.

2.2.5 Health Care Utilization—Health care utilization was assessed using the Healthcare Utilization (HCU) subscale of the Illness Attitude Scale that assesses factors associated with hypochondriasis (Kellner, 1986). This subscale contains questions about treatments received during the past year and about the frequency of visits to medical doctors, chiropractors, and other healthcare providers. The Illness Attitude Scales have adequate reliability in similar chest pain samples (Dammen, Friis, & Ekeberg, 1999), and reliability estimates in this study were in the adequate range: 0.90 for Health Anxiety, 0.78 for Illness Behavior, and 0.70 for Health Care Utilization.

2.3 Procedure

The Institutional Review Boards at the University of Missouri-Saint Louis, Boston University, and Beth Israel Deaconess Medical Center at Harvard Medical School approved this study. All patients seeking evaluation for a chief complaint of chest pain who showed no evidence of electrocardiogram changes during an exercise tolerance test and who were determined by their cardiologist to have NCCP were eligible to participate. Clinical physiologists informed patients that their testing showed no abnormalities during the exercise tolerance test, and patients were invited to participate in a research study on medical and psychological factors that may be associated with chest pain. Patients who agreed to be contacted by research staff completed an eligibility screen based on inclusion and exclusion criteria over the telephone. Eligible patients were invited to participate in a longitudinal study that included clinical interview and self-report questionnaires at four time points. Patients were compensated $25 for participation at each time point of the study. All patients were encouraged to participate in both the interview and questionnaire, and patients were permitted to do either the questionnaire or the interview only. Patients completed the questionnaire and returned it to the research office in a pre-paid envelope. Trained clinical psychology doctoral students or a licensed psychologist conducted the structured interviews.

3 Results

3.1 Descriptive Statistics and Preliminary Analyses

Mean, standard deviation, range, intercorrelations, and zero-order correlations for all study variables are reported in Table 1. The average alexithymia score (TAS-Total) was 48.07 with a standard deviation of 11.02 (Range 26 to 86). According to recommendations put forth by the developers of the scale, the range for alexithymia in this sample is that subjects scoring > or equal to 61 were identified as having elevated levels of alexithymia (Bagby & Taylor, 1997b); based on this, 11% of patients scored in the high alexithymia range, with

scores of 61 or higher. Nearly one-third of patients (29%) obtained moderate alexithymia scores of 51 to 60 (n = 45), and the remainder obtained scores in the low range and were not indicative of alexithymia. Men reported significantly higher overall alexithymia than women did on the TAS-Total scale, $F(1, 151) = 6.16$, $p < .05$, $d = .40$ and higher TAS-Difficulty Identifying Feelings subscale, $F(1, 151) = 6.21$, $p < .05$, $d = .40$.

With regard to chest pain, slightly more than one-half (55%) of patients reported experiencing chest pain for 6 months or longer, and 25% had experienced pain for 1–6 months. Most patients' (69%) chest pain was sudden and episodic, and the majority (55%) experienced at least one episode weekly. Typical painful episodes lasted less than five minutes for 38% of patients, 5 – 20 minutes for 25%, and longer than 20 minutes for 37% of the sample. Half (50%) of the sample reported chest pain of at least moderate intensity or greater. Seventy-two percent of patients reported one or two chest pain-related physician visits in the past year, and 11% reported three or more. Men and women did not differ on chest pain severity or chest pain related life interference at p's < .05. Health care utilization was higher among women compared to men in this sample, $F(1, 186) = 8.21$, $p < .01$, $d = .41$.

3.2 Associations between Alexithymia, Anxiety Sensitivity, and Pain

To explore the hypothesis that alexithymia and anxiety sensitivity would positively relate to life interference from chest pain and chest pain severity, correlations among these variables were examined for the total sample and across gender. Overall, alexithymia (TAS-Total) was associated with life interference from pain (MPI-Interference), $r(150)$, = .28, $p = .01$. Among the three TAS subscales, MPI-Interference was associated with both the TAS subscale that assesses difficulty identifying feelings (TAS-DIF, $r[151] = .32$, $p < .001$) and the TAS subscale that assesses difficulty describing feelings, TAS-DDF, $r(149) = .27$, $p < .01$. MPI-Interference was not associated with the subscale tapping externally oriented thinking (TAS-EOT), $p > .05$. Patients with higher alexithymia reported more pain interference; patients with greater difficulty identifying and/or describing their feelings also reported increased life interference from pain. In general, the correlation coefficients for TAS-Alexithymia were rather small. Contrary to the overall associations, analyses reported separately by gender (see Table 1) indicate that the alexithymia-pain interference correlation is only significant for men, $p < .001$. Overall alexithymia (TAS-Total) was positively associated with MPI-Severity, $r(151) = .24$, $p < .01$. Positive correlations were also found between the MPI-Severity and the two of the three TAS subscales (i.e., TAS-DIF and TAS-DDF but not TAS-EOT), r's .31 and .23, p's < .01. Patients with high alexithymia tended to report more severe pain, as did patients with greater difficulty identifying and/or describing their feelings.

Overall anxiety sensitivity (ASI-Total) was associated with life interference due to pain, MPI-Interference, $r(182) = .48$, $p < .001$. Among the three ASI subscales, MPI-Interference was strongly correlated with both physical concerns (ASI – Physical, $r[179] = .43$, $p < .001$) and mental concerns, ASI-Mental, $r(184) = .48$, $p < .001$. There was a smaller but still significant correlation between MPI-Interference and the anxiety sensitivity subscale that assesses fears of social concerns, ASI-Social, $r(184) = .29$, $p < .01$. Increased anxiety sensitivity was associated with more life interference from chest pain; and the anxiety sensitivity-pain interference link was somewhat stronger for physical and mental fears than for social fears. ASI-Total scores were positively associated with chest pain severity, MPI-Severity, $r(184) = .42$, $p < .01$. The strongest correlation among the ASI subscales and MPI-Severity was for ASI-Physical, $r(181) = .43$, $p < 01$. Pain severity was also associated with ASI-Mental and ASI-Social concerns, r's .37 and .22, p's < .01. Patients with higher anxiety sensitivity reported more severe chest pain, and there were positive associations between pain severity and all three anxiety sensitivity subscales. Scores on the anxiety sensitivity

subscale ASI-Physical were more strongly correlated with pain severity than scores on the other two subscales. In general, the correlation coefficients for Anxiety Sensitivity and its subscales were in the small to moderate range.

3.3 Hierarchical Regression Analyses Predicting Pain Interference and Severity

Hierarchical regression analyses were conducted to examine the unique and combined relations of gender, anxiety sensitivity, and alexithymia on life interference from chest pain and chest pain severity. The main effects of gender (Step 1), Alexithymia (TAS; Step 2), Anxiety Sensitivity (ASI; Step 3), and their interactions (2-way interactions on Step 4; 3-way interactions on Step 5) were examined in two equations (MPI-Interference, MPI-Pain Severity).

For MPI-Interference, the overall model predicted 18% of the variance (R^2_{adj}) at a small effect size, $f^2 = 0.21$. Gender was not associated with MPI-Interference. Alexithymia was associated with 8% of the variance ($F[2,144] = 7.31$, $p < .001$) and Anxiety Sensitivity was associated with 10% of additional variance ($F[3,143] = 11.61$, $p < .01$) in MPI-Interference. None of the interaction terms were significant.

For MPI-Pain Severity, the overall model predicted 13% of the variance (R^2_{adj}) at a small effect size, $f^2 = 0.19$. Gender was not associated with MPI-Pain Severity. Alexithymia predicted 5% of the variance ($F[2,145] = 4.92$, $p < .01$) and Anxiety Sensitivity was associated with 8% of additional variance ($F[3,144] = 8.44$, $p < .01$) in MPI-Pain Severity. All interactions were nonsignificant.

3.4 Stability of Alexithymia Across 18-Month Time Period

Exploratory analyses were conducted to examine the stability of alexithymia as measured by the TAS in this population over an 18-month time period. An attrition analysis was conducted to examine any differences between groups completing the questionnaire and those who dropped out of the study that may contribute to response biases. Test-retest reliability estimates were conducted at 6-, 12-, and 18-month follow-up time intervals.

3.4.1 Attrition—Of the total sample of patients who participated in this study, longitudinal data were obtained from all patients who were willing to participate at three data points following baseline, 6-, 12-, and 18-month follow-up (MFU). Ninety-eight patients participated at 6-MFU, 72 participated at 12-MFU, and 60 patients participated at 18-MFU. Parametric and nonparametric tests revealed no significant differences between the groups completing the questionnaire at different time points in age, sex, education, income, ethnicity, or employment status, p's > .05. The lack of group differences helps to ensure that no systematic bias influenced follow-up study participation.

3.4.2 Test-Retest Reliability Analyses—Test-retest reliability estimates for the Toronto Alexithymia Scale (TAS) for the Total Scale were $r = 0.76$ (Spearman correlation coefficient) for the 6-MFU, $r = 0.70$ for the 12-MFU, and $r = .65$ for the 18-MFU, p's < .001. With regard to the subscales, test-retest reliability for the TAS-Difficulty Identifying Feelings subscale (and distinguishing between feelings and somatic sensations) subscale were strong and stable over time at 0.74 at the 6-MFU, $r = 0.67$ for the 12-MFU, and 0.63 for the 18-MFU, p's < .001. Similarly, for the TAS-Difficulty Describing Feelings subscale, Spearman correlation coefficients were 0.72 at 6-MFU, 0.78 at 12-MFU, and 0.69 at 18-MFU, p's < .01. Finally, for the TAS-Externally Oriented Thinking subscale, test-retest reliability estimates were moderately stable and somewhat less so over time at 0.57, 0.47, and 0.41 for 6-MFU, 12-MFU, and 18-MFU, respectively, p's < .05.

3.4.3 Changes in Alexithymia Classification Across Time—In accordance with the published methods established by the scale authors (Taylor, Bagby, & Parker, 1997), we explored how clinical classification of alexithymia may change across the 6-, 12-, and 18-MFU. Patients were grouped into the respective levels of alexithymia, Low (TAS score of 50 or less), Moderate (TAS score of 51 to 60), and High (TAS score of 52 or higher); see Table 2. Overall, more than half of patients (62%) reported no change in their alexithymia status between baseline and 6-MFU (n = 49). Of those whose alexithymia status varied, most individuals showed changes from either Moderate to Low (16%, n = 13) or Low to Moderate (10%, n = 8). A similar percentage of patients demonstrated stable alexithymia characteristics between 6-MFU and 12-MFU (65%, n = 35). Again, among those individuals who showed varying alexithymia, individuals tended to be reclassified from either Moderate to Low (17%, n = 9) or Low to Moderate (11%, n = 6). A larger majority of patients reported stable alexithymia between 12-MFU and 18-MFU (88%, n = 35). Individuals with more variable alexithymia tended to shift upwards from either moderate to high (8%, n = 3) or low to moderate (5%, n = 2) levels of alexithymia.

4. Discussion

Consistent with our first hypothesis, alexithymia and anxiety sensitivity were associated with increased chest pain severity and pain-related life interference. Within the alexithymia construct, greater difficulty identifying and describing feelings were associated with higher pain severity. This finding is consistent with the idea that individuals who misperceive or are unable to verbally express affect-related bodily sensations, and therefore report fewer or less intense emotional experiences, report more severe physical pain. Overall alexithymia was also positively associated with chest pain related life interference; however, analyses separated by gender revealed that this association was only significant for men. Similarly, difficulties identifying and describing feelings were positively associated with chest pain interference in men, but not for women. This finding, along with the significantly higher alexithymia reported by men compared to women, suggests that men with high alexithymia may be particularly vulnerable to developing NCCP and experiencing functional impairment related to that ailment. Alexithymia was not associated with healthcare utilization by either men or women.

Anxiety sensitivity, as anticipated, was positively associated with pain severity, life interference from chest pain, and healthcare utilization. Additionally, hierarchical regression analyses demonstrated that anxiety sensitivity had a small but significant impact on the extent to which chest pain interfered with normal life activities. Of the three lower-order factors that exist within the main anxiety sensitivity construct, the factors thought to reflect physical concerns was more closely associated with increased life interference than were mental or social concerns. This finding is consistent with other empirical research demonstrating that NCCP patients fear cardiac-related physical sensations (Eifert et al., 1996; Lipsitz et al., 2004).

These results suggest that anxiety sensitivity and alexithymia may be important psychological factors in the etiology and maintenance of NCCP. As researchers have yet to find a satisfactory physiological explanation for NCCP, research examining the possible contribution of psychological factors to this ailment is increasing. Because many NCCP symptoms resemble the symptoms of panic disorder, models of anxiety disorders in general and panic disorder in particular are increasingly used to provide a theoretical framework for this research (White & Raffa, 2004). Some of the functional impairment suffered by NCCP patients may be attributable to the perception of anxiety-related sensations as danger signals. The cognitive interpretation of bodily sensations is recognized as relevant to NCCP etiology (Mayou, 1998). Patients who interpret chest pain as signaling an impending cardiac event

may be especially likely to restrict activity out of fear. The interpretation of heart-related sensations as dangerous may also affect the severity NCCP patients' pain. Anxiety sensitivity had a significant impact on chest pain severity. The lower-order anxiety sensitivity factor reflecting physical concerns was more closely associated with pain severity than the factors that reflect mental and social concerns. This finding suggests that NCCP patients who fear anxiety related physical sensations may report more severe chest pain. This is consistent with research demonstrating an association between NCCP patients' fear of heart-related sensations and chest pain intensity (Aikens, Zvolensky, & Eifert, 2001). Researchers and clinicians have suggested that NCCP patients develop hypersensitivity to physical sensations that they perceive as threatening (Esler & Bock, 2004). Patients who fear chest pain because they interpret it as dangerous may be especially sensitive to this pain.

NCCP patients who interpret chest pain as dangerous may also be especially likely to seek medical attention for that pain. Previous research has demonstrated that worry about a symptom impacts the decision to seek medical help, and worry over chest pain was the most common reason for seeking medical attention in a survey of NCCP patients (Eslick & Talley, 2004). The results of this study were in line with this research, as anxiety sensitivity was positively associated with rates of healthcare utilization.

Extending beyond anxiety sensitivity, this study indicates that alexithymia may be a clinically relevant correlate of the syndrome of NCCP. Alexithymia, originally developed to explain a characteristic of patients with psychosomatic illnesses, is a multifaceted personality construct characterized by deficits in the cognitive processing and regulation of emotions (Sifneos, 1973; Spitzer et al., 2005; Taylor & Bagby, 2004). Our analyses demonstrated a positive association between alexithymia and chest pain interference and severity. This association may reflect the difficulties perceiving and identifying emotions that accompany alexithymia (Kooiman et al., 2000; Lumley & Norman, 1996). The greater life interference reported by these patients may also reflect this tendency, as patients who attribute their chest pain to a physical cause might attempt to alleviate it by modifying physical activities. Neither chest pain interference nor severity was associated with the subscale that evaluates a tendency towards a utilitarian, externally oriented style of thinking. Our study is consistent with past studies demonstrating relatively low internal consistency across various samples, including the original norm group and the patient sample used in this study (Bagby et al., 1994; Kojima, Frasure-Smith, & Lesperance, 2001).

This study also examined the relationship between alexithymia and healthcare utilization. As some previous research suggested that individuals with alexithymia report more physical symptoms, it was expected that patients with alexithymia would show higher healthcare utilization rates (Byrne & Ditto, 2005). Contrary to expectations, our analyses did not demonstrate a relationship between alexithymia and healthcare utilization. Our results are consistent with one previous study in which alexithymia did not influence rates of primary healthcare utilization among frequent attendees at an outpatient healthcare center (Jyvasjarvi, Keinanen-Kinkaanniemi, Vaisanen, & Larivaara, 1998). Based on the results of the current study it appears alexithymia, although associated with increased suffering (e.g., pain severity and interference), may not be associated with seeking healthcare services to alleviate that suffering. An explanation previously suggested by researchers is that individuals with alexithymia tend to avoid or delay seeking medical attention (Lumley & Norman, 1996). The possible implications of this finding are troubling, as it suggests that NCCP patients with alexithymia may not seek out treatment despite experiencing outcomes that are more negative.

Finally, this study explored the stability of alexithymia across a short time interval (6-, 12-, and 18-month periods). As the first longitudinal examination of alexithymia in NCCP

patients, this study contributes to the growing body of research examining the psychology of this ailment. These results are relevant to the continuing debate on the nature of alexithymia; although often conceptualized as a personality trait, some consider it a transitory stress reaction in which individuals restrict affect to avoid emotional pain (Devine et al., 1999; Martínez-Sánchez et al., 2003; Nemiah, 1996). Others argue that alexithymia is best characterized as both a personality trait, or primary alexithymia, and a state reaction, referred to as secondary alexithymia (Marchesi et al., 2005; Muftuoglu et al., 2004). As personality traits are enduring by nature, temporal stability is an important distinction between primary and secondary alexithymia (De Gucht et al., 2004). The construct of alexithymia as measured by the TAS was stable across this rather short time interval as predicted. From a clinical perspective, most patients who scored within low, moderate, or high ranges at any one time-point scored within the same range six months later. This consistency suggests that alexithymia within NCCP patients may be best conceptualized as a stable, enduring personality trait, in accordance with alexithymia's original conceptualization. However, a notable minority achieved scores within different ranges at two sequential assessment points; this is consistent with the conceptualization of alexithymia as a state reaction. It is possible that in some NCCP patients, alexithymia scores reflect a transient stress response in addition to, or instead of, an enduring personality trait; further exploration of factors that might differentiate between patients who demonstrate consistent versus variable levels of alexithymia is needed.

These results need replication in light of study limitations. As few studies have exclusively examined NCCP patients, this study contributes to the growing body of literature on this disorder. However, the use of a specific patient population may limit the generalizability of these findings; our results are perhaps most applicable to patients suffering from medically unexplained ailments and from physical illnesses with significant psychological contributions, such as headaches and chronic pain. This study is also limited by the possibility of shared method variance, as these results relied on self-report data; this may be particularly problematic for conclusions concerning alexithymia. As alexithymia implies limited awareness of internal psychology, the appropriateness of assessing it through self-report may be questionable (Spitzer et al., 2005). Naturally, the use of a self-report measure of alexithymia somewhat paradoxical; that is, in the diminished ability to identify and describe affect, individuals may have difficulty completing self-report measures. While the scale used in this study represents a validated and most widely used measure of alexithymia, future research might benefit from supplementing the Toronto Alexithymia scale with observational or behavioral measures of alexithymia. Finally, the stability analyses herein were exploratory in nature and secondary to the primary goals in our manuscript. Despite our attempts to minimize potential sources of bias, test-retest methods of reliability analyses over short time intervals are subject to bias including subject dropout, maturation, and practice effects. Longitudinal research using powerful structural models are need to test a priori models of alexithymia and its stability over time to provide a more complete understanding of this construct.

4.1 Conclusions and Implications

NCCP has long been a frustration for the medical community, but psychological research examining the causes and correlates of this pain syndrome have important clinical utility. Anxiety sensitivity appears to represent a specific psychological vulnerability factor, and the cognitive appraisal of anxiety symptoms as dangerous may be a useful target of psychological intervention. Although most NCCP patients may be unlikely to have clinical significant alexithymia, patients with moderate or high alexithymia may represent an important subgroup that would benefit from specialized interventions to address their

emotional processing difficulties. Additionally, the subgroup of patients that demonstrated moderate to high alexithymia may require interventions that are more specialized.

The importance of intervention for this subgroup is emphasized by the finding that patients with higher alexithymia experience more severe pain and interference. Some evidence suggests that individuals with high alexithymia benefit from clinical interventions that include efforts to increase emotional awareness and facilitate the cognitive processing of emotional arousal (Taylor et al., 1991). This study expands research on psychological components of NCCP. The psychological factors anxiety sensitivity and alexithymia are likely to be associated with increased pain and individual impairment among medical patients suffering from this disorder. Additionally, anxiety sensitivity is associated with increased utilization of healthcare resources and may therefore contribute to the systemic impairment wrought by NCCP. As no satisfactory organic explanation for NCCP exists yet, exploration of psychological factors, such as anxiety sensitivity and alexithymia, which foster development and maintenance of this ailment, is an important step towards understanding the nature of NCCP. This deeper understanding is a prerequisite to the eventual development of intervention protocols that will effectively ameliorate the considerable individual and systemic impairment associated with this disorder.

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Table 1

Mean, Standard Deviation, Range, Intercorrelations, and Zero-Order Correlations For All Study Variables For Women (Above the Diagonal, N = 107) and Men (Below the Diagonal, N = 82)

Variable	1.	2.	3.	4.	5.	6.	7.	8.	*M*	*SD*	Range	*F*
1. Alexithymia (TAS-Total)	---	.84 **	.87 **	.61 **	.46 **	.11	.16	.17	46.24	10.73	26–74	6.16 *
2. Difficulty Identifying (TAS-DIF)	.90 **	---	.65 **	.24 *	.44 **	.13	.16	.22 *	15.29	5.44	7–31	6.21 *
3. Difficulty Describing (TAS-DDF)	.89 **	.59 **	---	.45 **	.42 **	.11	.15	.17	11.72	4.23	5–24	3.43 *t*
4. Externally Oriented (TAS-EOT)	.58 **	.30 *	.40 **	---	.13	−.04	.08	−.03	18.82	4.19	10–28	ns
5. Anxiety Sensitivity (ASI-Total)	.55 **	.60 **	.44 **	.25	---	.23 *	.44 **	.20 *	17.39	11.74	1–62	ns
6. Chest Pain Index-Severity	.15	.24	.19	−.23	.28 *	---	.47 **	.18 *t*	2.85	1.20	0–5.67	3.81 *t*
7. Pain Interference (MPI)	.48 **	.55 **	.49 **	−.03	.55 **	.49 **	---	.18	0.97	1.26	0–5.44	ns
8. Health Care Use (HCU)	.15	.16	.19	−.17	.24 *	.15	.45 **	---	8.74	2.55	4–17	8.21 **
Mean (*M*)	50.66	17.63	12.98	19.60	16.93	2.49	7.78	0.77				
Standard Deviation (*SD*)	11.03	6.11	4.03	4.26	12.35	1.29	1.82	0.99				
Range	28–86	7–33	5–25	9–29	9–29	0.17–5.2	5–12	0–4.11				

Note.

** $p < .01$.

* $p < .05$.

t $p < .07$.

TAS = Toronto Alexithymia Scale, *TAS-DIF* = TAS-Difficulty Identifying Feelings scale, *TAS-DDF* = TAS-Difficulty Describing Feelings scale, *TAS-EOT* = TAS-Externally-Oriented Thoughts scale, *ASI* = Anxiety Sensitivity Scale, *MPI* = Multidimensional Pain Inventory, *HCU* = Health Care Utilization scale.

Table 2

Toronto Alexithymia Scale Classification of Patients at Baseline and Changes Over the Course of Follow-Up

TAS Group Change[1]	Baseline to 6-MFU % (*n*)	>6-MFU to 12-MFU % (*n*)	>12-MFU to 18-MFU % (*n*)
No change	62.02 (49)	64.81 (35)	87.50 (35)
Low to Moderate	10.13 (8)	11.11 (6)	5.00 (2)
Low to High	n.a.	1.85 (1)	n.a.
Moderate to High	3.79 (3)	n.a.	7.50 (3)
Moderate to Low	16.45 (13)	16.67 (9)	n.a.
High to Low	3.79 (3)	1.85 (1)	n.a.
High to Moderate	3.79 (3)	3.70 (2)	n.a.
Total (*N*)	100.0 (79)	100.0 (54)	100.0 (40)

Note. *TAS* = Toronto Alexithymia Scale. *MFU* = Month Follow-Up. n.a. = Not Applicable.

[1] *Low* = TAS score of 51 or less, *Moderate* = TAS score of 52 to 60, *High* = TAS score of 61 or higher. Classifications in accordance with authors (Taylor et al., 1997).

Table 3

Test-Retest Reliability Estimates[1] for Toronto Alexithymia Scale

Scale	6-MFU (*n* = 98)	12-MFU (*n* = 72)	18-MFU (*n* = 60)
TAS-Total Scale	.76 ***	.70 ***	.65 ***
TAS-Difficulty Identify Feelings Scale	.74 ***	.67 ***	.63 ***
TAS-Difficulty Describing Feelings Scale	.78 **	.69 **	.69 **
TAS-Externally Oriented Thinking Scale	.57 *	.47 *	.41 *

Note. TAS = Toronto Alexithymia Scale. *MFU* = Month Follow-Up.

[1] Spearman correlation coefficient.

*** $p < .001$,

** $p < .01$,

* $p < .05$.