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Interoceptive Fear and Pain Anxiety in Non-cardiac Chest Pain: Is Fear Associated with Reduced Physical Activity?

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INTEROCEPTIVE FEAR AND PAIN ANXIETY IN NON-CARDIAC CHEST PAIN:

IS FEAR ASSOCIATED WITH REDUCED PHYSICAL ACTIVITY?

by

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Table of Contents

Title Page 1

Acknowledgements 2

Abstract 5

Introduction 6

Hypotheses 23

Method 25

- Design 25
- Participants 25
- Procedure 25
- Measures 27

Results 31

- Power Analysis 31
- Attrition 31
- Missing Data 32
- Descriptive Data 32
  - Table 1 *Patient demographics* 33
  - Table 2 *Physical activity in NCCP patients* 39
- Psychiatric Comorbidity 40
- Primary Analyses 41
  - Hypothesis 1 41
  - Hypothesis 2 41
    - Table 3 *Correlations among APPQ-I, PASS, and BRFSS* 42
  - Hypothesis 3 43

Discussion 43

- Results Review 44
  - Physical Activity Rates 44
  - Hypothesis 1 44
  - Hypothesis 2 44
  - Hypothesis 3 44
- Clinical Implications 44
- Strengths and Limitations 48
- Future Directions 51

References 53

Appendices 69

- Appendix A: *BRFSS Physical Activity Module* 69

Appendix B: *Measures stratified by psychiatric disorder status* 70
Table 4 *Physical activity stratified by Axis I disorder status* 72
Appendix C *Regression Results* 73
Table 5 *Regression: Pain anxiety and interoceptive fear on physical activity after controlling for marital status and income* 74

Abstract

Non-cardiac chest pain (NCCP) describes angina-like pain suffered by patients who lack a cardiac diagnosis (Fleet & Beitman, 1997). Despite a benign diagnosis, some NCCP patients continue to experience persistent pain, cardiac worry, impaired quality of life (Eifert, Hodson, Tracey, Seville, & Gunawardane, 1996), elevated rates of psychiatric disorders (Bass & Wade, 1984; White, et al., 2008), and negative health consequences (Eslick & Talley, 2008). Consistent with theory, research indicates that NCCP patients differentially fear cardiac sensations (Aikens, Zvolensky, & Eifert, 2001; White, Craft, & Gervino, 2010). It may be that NCCP patients avoid physical activity, which elicits feared cardiorespiratory cues; however, physical activity rates have not previously been identified. In the current study, physical activity was indexed in a NCCP sample and associations between interoceptive fear, anxiety about pain, and physical activity were examined. It was hypothesized that interoceptive fear and pain anxiety would be associated with lower physical activity after controlling for key demographic variables. NCCP patients ($N = 29$) who completed cardiac catheterization with <30% luminal diameter narrowing participated in the study. These results show that many NCCP are inactive (37%) or insufficiently active (41%) for cardiovascular benefits. Few patients (22%) are sufficiently physically active to minimally impact cardiovascular health. More NCCP patients are inactive compared to the general population. Initial correlations did not yield the expected relationships; physical activity, pain anxiety, and interoceptive fear were not associated. Results show that rates of a cardioprotective behavior, physical activity, are low in NCCP patients. Clinical implications, strengths and limitations of this study, and future directions in NCCP research are discussed.

Interoceptive Fear and Pain Anxiety in Non-Cardiac Chest Pain: Is Fear Associated with Reduced Physical Activity?

Each year in the United States, approximately 6 million people seek emergency treatment for chest pain or chest-related symptoms (American Heart Association, 2009). The majority of these patients receive no medical explanation for the pain (Braunwald, et al., 1994; Eslick, Coulshed, & Talley, 2002; Kroenke & Mangelsdorff, 1989). Despite the lack of a cardiac diagnosis, a group of patients are not sufficiently reassured (Potts & Bass, 1993) and may seek repeated cardiac evaluation for heart disease (Eslick & Talley, 2004b), placing a significant economic burden on medical care systems (Roberts & Kleiman, 1994). In addition to the burden on the health care system, NCCP negatively impacts quality of life. Compared to healthy controls, NCCP patients had impaired physical functioning, role difficulties due to physical limitations, and poor general health perceptions (Wong, et al., 2002). In fact, research has shown NCCP patients more frequently utilize medical care and have poorer mental health outcomes compared to patients with heart disease (Eifert, et al., 1996).

Medical diagnosis of NCCP. The available empirical data on diagnostic classification suggest that NCCP patients are likely a medically heterogeneous group. NCCP patients receive referrals to and present to different medical departments for assessment and treatment. The majority of published literature samples NCCP patients from cardiology and gastroenterology departments. After finding a low risk for cardiac disease, some NCCP patients receive referrals to gastroenterology departments to assess for esophageal motility disorders. Other commonly explored medical etiologies include musculoskeletal problems (i.e., "cervical angina"; Booth & Rothman, 1976), and less commonly, difficult-to-detect heart problems (i.e., non-obstructive CAD; Bugiardini & Bairey Merz, 2005). If patients have not been assessed for these disorders, it is unknown if another medical disorder accounts for the pain. For example, a patient presenting in cardiology who receives an NCCP diagnosis may truly have an undiagnosed esophageal motility disorder or possibly undiagnosed cardiac etiology.

For research progress in the area of persistent chest pain, appropriate definition of the patient group is paramount. Individual studies define NCCP patient groups by cardiac exclusion criteria, perhaps leading to group inconsistencies between studies. One reason for the importance of defining the NCCP patient group within a cardiology setting is to consistently rule-out other competing cardiac etiologies for the chest pain. Physicians base assessment procedures on information obtained in a clinical interview (e.g., chest pain quality, angina stability, pain duration, activities surrounding chest pain, comorbid disease, and risk factors) and findings from initial cardiac evaluations (Bugiardini & Bairey Merz, 2005). Following the clinical interview, chest pain is broadly classified as 'typical,' 'atypical,' or 'non-cardiac.' Typical chest pain is experienced under the chest bone and is often described as heavy or squeezing sensation with radiation to the arm or jaw, it is exacerbated by physical or emotional stress, and is relieved with rest or nitroglycerin (Fraker, Fihn, & Gibbons, 2009). Atypical chest pain meets two of the characteristics of typical chest pain. The third classification, non-cardiac chest pain, is chest pain with one or zero symptoms of typical chest pain. Further medical diagnostic tests are chosen based upon the qualitative and historical chest pain information obtained in the interview and initial assessments. The initial medical label of 'non-cardiac chest pain' does not sufficiently result in a diagnosis of NCCP. Instead, if subsequent cardiology assessment procedures fail to yield identifiable organic cause of the pain, an NCCP diagnosis is appropriate.

Individual studies define NCCP patient groups by different cardiac exclusion criteria, perhaps leading to some degree of group inconsistencies between studies. Some studies create NCCP patient groups based on a myriad of diagnostic procedures while others require a specific procedure to ensure within group consistency. Cardiac catheterization may be a more objective measure of artery blockage in patients to define CAD versus NCCP, but few studies consistently utilize this procedure for all participants. Cardiac catheterization is the clinical "gold standard" for CAD diagnosis and allows clinicians to diagnose CAD with nearly 100% certainty (Noto, et al., 1991). Although cardiac catheterization may strengthen the assertion that an NCCP sample is truly free of heart disease, the procedure lacks the specificity to detect other non-obstructive cardiac causes of chest pain, such as microvascular angina. These disorders are only diagnosable through additional functional testing, such as coronary reactivity testing, and their use is limited by economic and availability constraints (Bugiardini & Bairey Merz, 2005). NCCP patients who undergo cardiac catheterization may be insufficiently reassured by less invasive procedures to rule-out CAD. Therefore, NCCP patients who undergo cardiac catheterization may have different overall group characteristics than NCCP patients who do not have this cardiac diagnostic procedure.

Psychiatric comorbidity in NCCP. Research consistently reveals elevated rates of psychiatric comorbidity in NCCP patients. Early NCCP research showed two-thirds of patients with near-normal arteries (defined as less than 50% lesioned based on cardiac catheterization) and a presenting complaint of chest pain met psychiatric disorder criteria (Bass & Wade, 1984; Bass, Wade, Hand, & Jackson, 1983). Some reports indicate a 34% comorbidity rate between panic disorder and NCCP (Beitman, et al., 1989). In a more recent sample of treatment-seeking patients with chief complaints of chest pain, the rates of diagnosable Axis I disorders reach nearly 50% with panic disorder as one of the most common principal diagnoses (White, et al., 2008). Mood disorders were present in 17% of this sample and over 70% of NCCP patients experienced at least subthreshold disorders. This study used trained clinical diagnosticians to extrapolate psychiatric diagnosis. Other research has documented the increased incidence of psychiatric comorbidity in NCCP patients compared to CAD patients. Research suggests panic disorder is disproportionately higher in patients with NCCP compared to patients with CAD (Beitman & Basha, 1992; Dammen, Arnesen, Ekeberg, & Friis, 2004). Methodological limitations and inconsistencies in studies of NCCP and psychiatric comorbidity may contribute to the ranges of psychiatric comorbidity observed. Specifically, some studies utilize only self-report data to diagnose psychiatric comorbidity. Studies could be improved by also obtaining clinical interviews to clarify the most basic questions of rates of comorbid psychiatric diagnosis in NCCP.

Negative Health Outcomes in NCCP

Mortality in NCCP. Although an NCCP diagnosis indicates lack of CAD etiology, recent research suggests the disorder may not be physiologically benign. One study examined four-year cardiac mortality rates in NCCP patients and CAD patients (Eslick & Talley, 2008). In this design, patients presented to an emergency department in a teaching hospital with a primary complaint of chest pain. The patients completed questionnaire data consisting of the Chest Pain Questionnaire (CPQ; Eslick & Talley, 2004a), the Beck Anxiety Inventory to assess for panic disorder, and other questionnaires that measured general health status (SF-36 Health Survey), depression and anxiety (Hospital Anxiety and Depression Scale), and GERD (Gastro-oesophageal Reflux Questionnaire). A cardiac work-up comprised of chest X-ray, cardiac enzymes, blood pressure, resting electrocardiogram (ECG), and exercise tolerance test (ETT) was performed. From this, patients were classified as NCCP (*N* = 126), CAD (*N* = 71), and/or "continued chest pain" or recurrent chest pain at a rate of at least once per month over a year. At 2- and 4-year follow-up, patients completed the questionnaire battery. During the 4-year follow up, medical records were obtained and reviewed on all patients, including those who died during that time period. Age was the only significant predictor of all-cause mortality; cardiac status did not independently predict all-cause or cardiac mortality, suggesting that at follow-up, patients diagnosed with NCCP at baseline had similar cardiac mortality rates to CAD patients. In all, 17 patients died over the four-year follow-up period; 8 CAD patients and 7 NCCP patients died of acute myocardial infarction, the remaining 2 deaths were due to other causes. In sum, NCCP or cardiac disease status failed to differentiate between the groups on likelihood of cardiac mortality.

This study provides preliminary evidence for similar CAD mortality risk in NCCP and CAD patients (Eslick & Talley, 2008). According to the authors of this study, a weakness was a lack of consistency of cardiac evaluation procedures, specifically, not all patients completed a coronary angiography. The authors noted cardiac causes could not be definitively ruled-out in the NCCP group based upon the lack of this procedure.

However, coronary angiography fails to ensure the absence of any other cardiac causes (e.g., microvascular angina), which are only detected through additional functional assessment, such as coronary reactivity tests. A strength of this study was the inclusion of some specialized testing (i.e., gastrointestinal, additional cardiac testing) performed based on symptom presentation. The study included patients who may have other medical etiologies for their pain, including GERD-like symptoms, and the authors discussed the impact of GERD on some additional measures of quality of life.

Other results suggest NCCP is a physiologically benign syndrome with cardiac mortality rates that are no different than expected by population base rates. One study that yielded such results defined “angina-like” chest pain by negative coronary angiograms in 145 patients (Lichtlen, Bargheer, & Wenzlaff, 1995). Still other studies show greater cardiac mortality rates in male NCCP patients compared to a healthy control group (Bodegard, Erikssen, Bjornholt, Gjesdal, et al., 2004). Replication may clarify the mortality rates for NCCP patients.

Some recent evidence reveals similar cardiac mortality rates between NCCP patients and CAD patients; however, no causal data support a link between NCCP and CAD. NCCP may be associated with an increased risk for CAD through the amplification of cardiac risk factors. Daily health choices can be either health compromising or health promoting. For example, sedentary lifestyle as indexed by lower levels of physical activity may serve to accelerate cardiac risk factors, such as hyperlipidemia and the metabolic syndrome. This risk may be especially elevated in NCCP patients, perhaps through mechanisms of anxiety, such as interoceptive fear and behavioral avoidance. Evidence suggests NCCP patients fear and avoid physical activities that elicit cardiorespiratory cues (Craft, Brooks, McDonnell, White, & Gervino, 2007) and that 79% of an NCCP sample group fail to meet national physical activity requirements for measureable health benefits compared to 60% of the total United States population (Craft, Fitzsimmons, White, & Gervino, 2008). This early research indicates a sizable portion of NCCP patients engage in a sedentary lifestyle. In a study of CAD risk factors in NCCP patients, on average, patients reported four (*SD* = 1.6) CAD risk factors (White, Malone, Covino & Gervino, 2006). The three most common risk factors are family history of CAD (46%), a sedentary lifestyle (42%), and obesity (34%). Although these data suggest NCCP patients lead sedentary lifestyles, no published data have directly examined activity in day to day life in NCCP patients.

Summary. Although some recent research suggests elevated rates of cardiac mortality in NCCP patients, no published data exist to link NCCP and CAD risk. The rates of psychiatric disorders, particularly anxiety disorders, are elevated in NCCP samples. Limited research in the area of CAD risk factors in NCCP patients reveals sedentary lifestyle in many NCCP patients. Factors theorized to contribute to development and maintenance of NCCP include cardiac-congruent fear and avoidance. Perhaps these mechanisms promote lower levels of activity that may ultimately impact physical health. Leading NCCP theories assert that vigilance to and fear of cardiorespiratory cues contributes to avoidance of behaviors that elicit cardiorespiratory cues.

NCCP Theories

Poor physical health, mental health, and quality of life outcomes are associated with a NCCP diagnosis, including similar 4-year cardiac mortality rates compared to

CAD patients (Aikens, Michael, Levin, & Lowery, 1999; Eifert, et al., 1996; Eslick & Talley, 2008; Wong, et al., 2002). Inadequate medical explanations have lead researchers to theorize biological, psychological, and social factors cause and maintain the disorder. Leading NCCP theories cite that multiple predisposing factors (e.g., illness experience, experience of medical care) and precipitating factors (e.g., life stress, psychiatric vulnerability) cause the experience and interpretation of chest pain as harmful (Mayou, 1998).

White and Raffa (2004) highlight multiple causes of NCCP, including a preoccupation with heart-focused worry. Their model shares features with and builds upon empirically supported models of panic disorder and health anxiety (White & Barlow, 2002). In panic disorder theories, as believed in NCCP, physical sensations fulfill a pivotal role in the development and maintenance of the disorder (Barlow, 1988, 2002; Clark, 1986). Individuals who develop panic disorder have both a physiological vulnerability (e.g., increased autonomic reactivity) and a psychological vulnerability (e.g., increased anxiety sensitivity, the tendency to interpret anxiety as harmful) for developing the disorder (Barlow, 1988, 2002). During the first physiological arousal, attention shifts internally to physical sensations and vulnerable individuals cognitively interpret these sensations as harmful. Thus, each future time the associated physical sensation is experienced, patients experience fear. This leads to anxious apprehension for future episodes of bodily or interoceptive cues now paired with anxiety and fear and avoidance of activities that tend to elicit feared interoceptive cues. The feared interoceptive cues in NCCP are cardiovascular in nature, so it is theorized that behaviors that elicit cardiovascular cues, such as physical activity, are avoided.

NCCP, Comorbid Psychiatric Disorders, and Behavioral Avoidance

NCCP theories assert the role of psychological constructs to characterize vigilance to cardiac sensations and avoidance of behaviors that elicit cardiorespiratory cues. The avoidance of activities that elicit cardiorespiratory cues, such as physical activity, may serve to amplify future cardiac risk and lead to poorer physical and psychological outcomes. Published research has examined cognitive components that cause and maintain NCCP, but few studies index behavioral avoidance and sedentary lifestyle. The following section will outline psychological factors in NCCP patients that may contribute to physical activity avoidance.

Cardiac anxiety. Cardiac anxiety or heart-focused worry is a distinct form of anxiety compared to other forms of anxiety and health anxiety (Eifert, et al., 2000). It is defined as persistent worry about cardiac functioning and sensations based on the fear of their outcomes (e.g., myocardial infarction or sudden cardiac death). In a comparison study of 96 CAD patients to 52 NCCP patients, heart focused attention and fear predicted severity of cardiac and cardiac-like symptoms in both patients with and without CAD (< 30% stenosis; Zvolensky, Eifert, Feldner, & Leen-Feldner, 2003). This study controlled for key demographic variables and CAD risk factor variables (e.g., body mass index). Cardiologists determined CAD-status through cardiac catheterization.

Hypervigilance. Theories of anxiety emphasize the role of hypervigilance in how cognitions maintain behavioral avoidance (Barlow, 2002). Anxious patients are attentive for threatening information. A review of studies utilizing the emotional Stroop task, showed (with few exceptions), individuals with higher levels of anxiety display longer response latencies for words that resembled their feared cognitions (Williams, Mathews,

& MacLeod, 1996). The emotional Stroop task measures disorder-specific maladaptive cognitions and fears (i.e., individuals with specific phobia may fear words such as ‘spider’ or ‘storm,’ but individuals with a panic disorder symptom profile may differentially fear words such as ‘breath’ or ‘heart’). Studies consistently show that anxious individuals attend to threatening stimuli more than less anxious individuals (Lavy, van den Hout, & Arntz, 1993; MacLeod, Mathews, & Tata, 1986; MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002; Maidenberg, Chen, Craske, Bohn, & Bystristsky, 1996).

Interoceptive sensitivity. Interoception is the internal sensation and subsequent interpretation of the physiological condition of the body (Craig, 2002). Interoception can be an adaptive function; however, the functionality of this process ceases when the appraisal turns to hypervigilance and takes up a good portion of attention and time. Further, interoception is no longer functional when behaviors such as anxious avoidance interfere with daily life. The process of interoception is instrumental in the development of panic disorder (Barlow, 2002; Reiss & McNally, 1985). One component in the etiology of panic is the misappraisal of benign physical sensations as threatening. Laboratory evidence suggests that interoceptive fear best predicts physiological anxious responding. In a non-clinical population, fear of suffocation was the best predictor of behavioral response during a challenge that induced respiratory cues (McNally & Eke, 1996). A comparison study of NCCP patients to non-clinical participants showed that NCCP patients exhibit heightened response to a procedure that elicits cardiorespiratory cues, suggesting the possibility this effect may be even more pronounced in patients with NCCP (Beck, Berisford, & Taegtmeyer, 1991).

Differential specificity hypothesis. NCCP patients have greater interoceptive fear for cardiorespiratory cues. In one study, patients with NCCP feared physical symptoms and cardiac symptoms based upon their endorsement of cardioprotective beliefs (Aikens, et al., 1999). In this sample of 45 NCCP patients, panic symptomology and cardioprotective beliefs accounted for 62% of the variance in chest pain severity and 57% of the variance in emergency department visits. Chest pain chronicity and severity were predicted by level of cardioprotective beliefs, as motivated by cardiac fear. These data show that NCCP patients have a tendency to experience interoceptive fear, and specifically cardiac fear. This research has several limitations, including the reliance on self-report measures for psychological characteristics, as opposed to standardized clinician-administered interview data.

Later research by this group explored the possibility of a differential specificity hypothesis (Aikens, et al., 2001). These researchers hypothesized this based on high comorbidity between NCCP and anxiety disorders and heightened emotional reactivity in NCCP patients. They reasoned NCCP patients' lower tolerance of cardiac challenge tests (Bradley, Richter, Scarinci, Haile, & Schan, 1992) may be due to NCCP patients' hypervigilance to and fear of cardiac cues. The differential specificity hypothesis asserts that individuals are particularly attentive and sensitive to certain sensations above other sensations. This may have developed from the catastrophic misappraisal of certain bodily cues. To study this, Aikens, Zvolensky, and Eifert (2001) obtained data from 63 NCCP patients presenting in an emergency department with chief complaints of chest pain and at least one prior chest pain evaluation. The sample was predominately African American, middle aged (*M* age = 49), and was equally dispersed between genders. A self-report panic measure showed 51% of the patients met criteria for panic disorder. Participants completed the Body Sensations Questionnaire, assessing for fear of a variety of interoceptive cues, including cardiovascular and gastrointestinal sensations (Chambless, Caputo, Bright, & Gallagher, 1984). Patients also completed a measure of cardiac distress. The researchers found that NCCP patients differentially fear cardiopulmonary sensations compared to gastrointestinal sensations, numbness, and dissociation. Additionally, cardiopulmonary fear predicted cardiac distress.

NCCP patients feared cardiopulmonary sensations at a greater degree than other physical sensations, such as gastric sensations or numbness (Aikens, et al., 2001). However, this research did not address the possibility that anxiety disorder status may account for the fear of body sensations. It is possible that anxiety disorder status mediates differential specificity. Additionally, Aikens et al.'s research did not account for the possibility that attentional focus on pain symptoms may account for increased experience and report of pain. Building upon Aikens, Zvolensky, & Eifert's (2001) research, White, Craft, and Gervino (2010) sought to address the role of cardiovascular vigilance and cardiac anxiety on NCCP patients with and without psychiatric disorders. In this study, 229 patients (*M* age = 50 years; 56% female) seeking cardiac evaluation with chief complaints of chest pain and negative cardiac history participated. Participants were included if they showed no abnormalities following a general medical exam, and an exercise stress test. These patients completed the Anxiety Disorders Interview Schedule for the Diagnostic and Statistical Manual-4th Edition Lifetime Version (ADIS-IV-L; Di Nardo, Brown, & Barlow, 1994), a clinician-administered interview for the diagnosis of anxiety and mood disorders, with screening questions for psychoses and substance abuse disorders, the Multidimensional Pain Inventory (MPI; Kerns, Turk, & Rudy, 1985), the Body Vigilance Scale (BVS; Schmidt, Lerew, & Trakowski, 1997), and self-report measures of depression and anxiety. The Albany Panic and Phobia Questionnaire (APPQ; Brown, White, & Barlow, 2005) measured interoceptive fear and the Cardiac Anxiety Questionnaire was used to assess fear of cardiac sensations based upon feared consequences (CAQ; Eifert, et al., 2000).

Compared to non-cardiac sensations, NCCP patients were significantly more vigilant and psychiatric comorbidity led to overall heightened body vigilance and vigilance specifically for cardiorespiratory cues (White, Craft, & Gervino, 2010). Interoceptive fear mediated the relationship between cardiac anxiety and chest pain and partially mediated the correlation between body vigilance and chest pain. These results show that focused attention on bodily sensations overall, and specifically to cardiac sensations, is associated with an increase in reported levels of chest pain. Additionally, the relationship between cardiac anxiety and chest pain is accounted for by interoceptive fear. This research has important implications for our understanding of the syndrome of NCCP. These results suggest that one reason for the physical manifestation of anxiety is that patients focus their anxious attention on physical cues, heightening them, which results in the physical expression of anxiety. Although interoceptive fear mediates this relationship, the impact of interoceptive fear on physical activity is largely unexplored.

Physical activity avoidance in NCCP. Some research suggests NCCP patients engage in reduced cardiovascular health promoting activities, though published studies in this area are limited. Available data support the role of amplified cardiorespiratory sensation avoidance in NCCP patients. In a comparison of heart-focused anxious NCCP patients to cardiac patients, surgical patients, and non-diseased control participants (Eifert, et al., 1996), NCCP patients reported higher levels of cardioprotective behaviors than surgical patients and control participants. The patients in all four groups completed the Cardiac Anxiety Questionnaire (CAQ; Eifert, et al., 2000) to assess for avoidance of physical exertion and overexcitement (Cardioprotective Behavior), medical help seeking, and difficulty relaxing (Hyperarousal), and the degree to which patients believe they have heart disease and awareness of their heart disease (Cardiac Disease Conviction/Heart Awareness). Participants also completed measures of body sensation, agoraphobic and phobia-related fears, and symptoms of anxiety and mood disorders. A clinician-administered Anxiety Disorders Interview Schedule-Revised (ADIS-R; DiNardo & Barlow, 1988) assessed for presence of Axis I anxiety and mood disorders.

In this patient group, 65% of NCCP patients met criteria for a diagnosable Axis I disorder, most commonly, panic disorder (compared to 15% of cardiac patients, 17% of surgical patients, and 10% of the control group). NCCP patients were more convinced they had cardiac problems than surgical patients and non-patients and noted a significantly higher amount of symptoms (e.g., sleep disturbance, general tension) that affect quality of life than the comparison groups. Notably, the NCCP patient group reported significantly lower levels of cardioprotective behaviors on that subscale of the CAQ compared to the CAD patient group. However, NCCP patients reported significantly higher levels of cardioprotective behaviors compared to surgical patients and non-diseased control participants. This finding is notable because NCCP patients reportedly avoid cardiac-symptom inducing activities at rates that exceed other patient groups, but at a lower rate than CAD patients.

Additional laboratory data indicate low tolerance for chest-pain specific sensations in NCCP patients. Chest pain patients presenting for gastroesophageal evaluation also show lower pain thresholds for gastro-specific procedures compared to other pain sensations (Bradley, et al., 1992). Preliminary work shows that NCCP patients with increased interoceptive sensitivity have lower output on exercise tolerance tests (Stein, White, Berman, Covino, & Gervino, 2009).

Kinesiophobia. A related concept to the idea of differential specificity for cardiorespiratory cues leading to behavior avoidance, specifically exercise avoidance, is kinesiophobia. Kinesiophobia is the fear of physical movement due to concerns of injury stemming from the physical activity (Kori, Miller, & Todd, 1990). For example, a person with an Achilles injury may avoid physical activities that rely on the lower body. Similar to theories of NCCP, theories of kinesiophobia assert etiology and maintenance through a fear and avoidance model (Vlaeyen & Linton, 2000). In a patient with kinesiophobia, avoidance is reinforced because it may reduce short-term physical pain (Martins, Gouveia, & Parreira, 2006). However, avoidance of physical activity can inhibit healing. Therefore, a kinesiophobic response can lead to further poor health consequences and outcomes.

No published research examines the role of kinesiophobia in NCCP and health compromising behaviors; however, the condition has been examined in several other disorders and conditions. Fear of physical activity predicted low exercise output on behavioral measures in patients with chronic fatigue syndrome (Silver, et al., 2002). Other studies on chronic fatigue syndrome and fear of movement show no effect of kinesiophobia on disability or exercise output (Nijs, Vanherberghen, Duquet, & De

Meirleir, 2004). In addition to behavioral measurements, kinesiophobia leads to decreased quality of life. Some evidence for the detrimental role of kinesiophobia on quality of life comes from the larger pain literature. In the pain literature, kinesiophobia predicts disability in chronic back pain patients (Crombez, Vlaeyen, Heuts, & Lysens, 1999). However, some of this evidence suggests kinesiophobia does not predict duration of neck pain in post-motor vehicle accident victims (Buitenhuis, Jaspers, & Fidler, 2006). The majority of the literature that examines behavioral avoidance in NCCP is based upon self-report, often indexed with single-item measures, as opposed to psychometrically validated questionnaires or direct measurement.

Available data on behavioral avoidance in NCCP patients are almost exclusively self-report leaving them vulnerable to bias, particularly social desirability and recall bias (Johansson, Solvoll, Bjorneboe, & Drevon, 1998; Rzewnicki, Vanden Auweele, & De Bourdeaudhuij, 2003). Increased physical activity improves anxiety and panic symptoms (Paluska & Schwenk, 2000; Smits, Powers, Berry, & Otto, 2007; Smits & Zvolensky, 2006) and benefits cardiac health (Warburton, Nicol, & Bredin, 2006). However, early research indicates NCCP patients lead sedentary lifestyles (White, et al., 2009) and, therefore, may not experience the positive physical and psychological health aspects of a more active lifestyle. These data were obtained via self-report or laboratory measures. Direct, objective measures of physical activity or empirically examined self-report measures may more accurately represent these patients' daily activity level. If behavioral measures of sedentary lifestyle indicate NCCP patients are inactive, they fail to engage in these behaviors and which contributes to increased cardiac risk. Additionally, these behaviors may also serve to improve anxious symptoms.

The Current Study

A burgeoning body of research indicates this patient group may experience a host of negative physical health, mental health, and quality of life outcomes. Evidence suggests adverse psychological outcomes in NCCP patients as well as elevated cardiac mortality rates (Eslick & Talley, 2008). Leading theories of NCCP cite physiological, psychological, and social influences on the development and maintenance of the disorder (Mayou, 1998; White & Raffa, 2004). NCCP may develop and persist partly through an association of fear with symptoms of chest discomfort and heightened vigilance to chest sensations. This fear may lead to anxious avoidance of sensations, especially those associated with chest pain. Research suggests that NCCP patients differentially avoid cardiorespiratory cues more than other somatic sensations (Aikens, et al., 2001). In fact, NCCP patients are distinctly vigilant to cardiac-like symptoms and this effect is amplified for those NCCP patients who suffer from anxiety disorders. Moreover, interoceptive fear has been shown to mediate the anxiety-chest pain relationship (White, Craft, & Gervino, 2010).

Evidence suggests NCCP patients differentially fear cardiac-congruent symptoms, over-attend to cardiac-congruent symptoms, and that interoceptive fear accounts for the relationship between cardiac anxiety and chest pain. However, the impact of interoceptive fear on daily activities that elicit cardiovascular cues is largely unexplored. Indexing daily health compromising behaviors, such as sedentary lifestyle, is important in this population because lower levels of physical activity serve to amplify factors that increase cardiac risk (i.e., metabolic syndrome; AHA, 2009). Additionally, increased physical activity has implications for reducing anxiety symptoms (Paluska & Schwenk, 2000; Smits, et al., 2007) and improving cardiac health (Warburton, et al., 2006). NCCP research and physical activity research face several challenges. NCCP diagnostic techniques rely on clinical interview data and may consist of a number of patients for whom a medical diagnosis accounts for the pain (Bugiardini & Bairey Merz, 2005). In some studies, questionnaires with questionable validity have been utilized and gold-standard psychiatric comorbidity diagnostic techniques fail to be utilized. Studies that have examined sedentary lifestyle in NCCP patients rely on self-report indices, some with questionable psychometric properties, and are subject to social desirability and recall bias.

The current study indexed and described physical activity via an empirically validated interview measure in a sample of non-CAD and NCCP patients. Patients completed the gold-standard measure of CAD, cardiac catheterization, with results of less than 30% luminal diameter narrowing. The association between fear of cardiac sensations and anxiety about pain was examined in relation to daily activity levels (measured by an interview measure of physical activity). Next, these relationships were examined after controlling for factors that have been shown to impact healthy lifestyle behaviors, marital status (Umberson, 1992) and income (Lantz, et al., 1998).

Hypotheses

The following hypotheses were proposed:

1) In a sample of NCCP patients, higher levels of interoceptive fear (The Albany Panic and Phobia Questionnaire-Revised, Interoceptive Subscale [APPQ-I]) will be associated with lower levels of physical activity (as measured by the Behavioral Risk Factor Surveillance

System Physical Activity Module [BRFSS] and pedometer data). A significant, negative correlation between APPQ-I scores and physical activity is expected.

2) In a sample of NCCP patients, fear of pain (The Pain Anxiety Symptom Scale [PASS], total score) will be associated with lower levels of physical activity (as measured by the BRFSS and pedometer data). A significant, negative correlation between PASS total scores and physical activity is expected.

3) Demographic factors, including marital status and income, have been linked to healthy lifestyle behaviors. Main effects of these demographic factors on physical activity (as measured by the BRFSS and pedometer data) will be examined. After examining the main effects of these factors, the associations between interoceptive fear and pain anxiety will predict significant variance in physical activity (as measured by the BRFSS and pedometer data). Higher levels of interoceptive fear (APPQ-I) and higher levels of anxiety due to pain (PASS) will continue to be significantly associated with lower levels of physical activity (BRFSS and pedometer data).

Method

Design

The design of this study was cross sectional and multimodal.

Participants

Patients (*N* = 29) were recruited from a university-affiliated medical center cardiology department. Inclusion criteria for the study were: 1) At least 21 years of age, 2) Chief complaint of chest pain or discomfort, 3) Completion of cardiac evaluation, including cardiac catheterization, 4) Cardiac catheterization evidence of normal or non-obstructive coronary arteries (less than or equal to 30% luminal diameter narrowing), and 5) English language proficiency. Participants were excluded from the study based on the following criteria: 1) Uncontrolled heart disease as determined by treating physician, 2) Medically contraindicated participation as determined by treating physician, 3) Any other uncontrolled significant medical illness, 4) Current severe psychiatric illness, including drug or alcohol abuse, active suicidal or homicidal ideation, 5) Inability to communicate in English, and/or 6) Score of < 20 on the Cognitive Capacity Screening Examination (CCSE). None of the patients in the current study were assessed for cognitive impairment. Participants were compensated with a $25 gift card for their participation in any portion of the study.

Procedure

Patients were recruited from a large, urban Midwestern university-affiliated cardiac catheterization laboratory. Nursing staff approached all patients with a chief complaint of chest pain and negative cardiac evaluation (including cardiac catheterization results of less than or equal to 30% stenosis) with a study recruitment flyer. If potential participants were interested in hearing more about the study, they indicated this by signing the flyer and returning it to the nurse. The potential participants were contacted via telephone, provided with extensive information about the study, and they provided verbal consent. At this stage, patients were screened for the additional inclusion/exclusion criteria. Patients who met criteria were mailed the written informed consent form and the questionnaire battery. They were also scheduled for the phone interview. When available, patients were also mailed the pedometer and instructions for its use. The questionnaire battery takes approximately 30-45 minutes to complete. The ADIS-IV-L and BRFSS were completed by trained doctoral level graduate students and take 65-95 minutes total to complete. Patients returned the materials via postage-paid envelopes.

Patients who agreed to participate in the pedometer data collection were instructed to wear the pedometer in accordance with the manufacturer's guidelines for seven days. They were instructed to wear the pedometer all day, each day, from waking until going to bed, except when sleeping, showering, or swimming. The SW-701 contains an internal recording device that recorded up to two weeks of daily readings. Patients also recorded their daily number of steps in a log as another indicator of physical activity in the event of user error or mechanical problems. Patients were provided with a self-addressed, postage-paid protective envelope to return the pedometer and log. To ensure adequate compliance, participants received a reminder phone call after the first night of pedometer usage to inquire about any concerns regarding how to properly use the device. A reminder letter was mailed to reach the patient several days in to the week. Pedometer data were collected from 6 patients. Upon the mailing of the pedometers to the next set of patients, the devices were not returned within a reasonable time limit. Telephone contact with these patients was attempted; however, the patients were unable to be contacted and/or did not return the pedometers. Next, a letter was sent to these patients with an additional postage-paid envelope, indicating to return the pedometer or to call if they would prefer the researcher pick up the device from their home. No patients responded to the letter and the pedometer portion of the study was terminated due to lack of the necessary instrumentation.

Measures

Chest pain characteristics. The Chest Pain Episodes Questionnaire (CPEQ) measures chest pain characteristics including frequency, intensity, duration, and quality of pain. Patients reported major medical history, cardiovascular health history, and medication use. The measure is based upon a 3-item cardiology questionnaire that indexes typicality of chest pain during the medical diagnostic clinical interview (Wu, Smeeton, & Chambers, 2001).

Psychiatric morbidity. To assess for Axis I morbidity, a semi-structured diagnostic interview, the Anxiety Disorders Interview Schedule for the Diagnostic and Statistical Manual-4th edition (DSM-IV; American Psychiatric Association, 2000) Lifetime Version (ADIS-IV-L) was administered (Di Nardo, et al., 1994). The ADIS-IV-L interview comprehensively assesses for DSM-IV anxiety, mood, somatoform, and substance use disorders and screens for other major psychological disorders (e.g., psychosis). The trained clinical interviewer assigned a clinical severity rating (CSR) ranging from “0” (no interference or distress) to “8” (extreme interference or distress) points. A CSR of “4” or greater indicates that the clinician judges the severity of a disorder to be of clinical significance; a CSR lower than “4” indicates a subclinical disorder. The principal diagnosis is assigned to the diagnosis with the highest CSR. A strength of the ADIS-IV-L is its ability to both categorically and dimensionally (based on CSRs) define psychiatric diagnosis. The ADIS-IV-L has good to excellent inter-rater reliability for current disorders (range of κ’s = 0.67-0.86; Brown, Campbell, Lehman, Grisham, & Mancill, 2001). Trained doctoral-level clinical psychology students administered the ADIS-IV-L to patients and rated results.

Anxiety surrounding pain. The Pain Anxiety Symptoms Scale (PASS) is a 40-item questionnaire that measures fear of pain across cognitive, behavioral, and physiological domains (McCracken, Zayfert, & Gross, 1992). Patients rated how much they think about or do different behaviors in response to pain. They responded to each statement from “1” (Never engage in this thought or activity) to “5” (Always engage in this thought or activity). The total score of anxiety surrounding pain was examined in this study. Internal consistency of the measure is excellent (Chronbach’s $\alpha = 0.94$; McCracken, et al., 1992) and studies have consistently shown adequate test-retest reliability (McCracken & Dhingra, 2002). The PASS has moderate to large significant correlations (r’s = 0.29 to 0.73) with other measures of anxiety and pain-related anxiety, suggesting adequate construct validity and research indicates the PASS uniquely contributes to measurement of anxiety about pain after controlling for other psychological distress and disability (p’s < 0.01; McCracken, et al., 1992). Cronbach’s α for the current study was 0.95.

Interoceptive fear. The Albany Panic and Phobia Questionnaire-Revised (APPQ) is a 24-item questionnaire designed to index situational, interoceptive, and social fear

(Brown, et al., 2005). The interoceptive subscale (APPQ-I) required patients to rate the degree to which they would expect to fear different physical activities and sensations (e.g., hiking on a hot day; exercising vigorously by oneself). Patients rated their expected fear on a Likert scale ranging from "0" (no fear) to "8" (extreme fear). The APPQ-I has good internal consistency (Chronbach's $\alpha = 0.86$). Convergent validity with other measures of panic-related symptoms and physical concerns on the Anxiety Sensitivity Index is strong (p's < 0.001) and discriminant validity from measures of social anxiety is adequate (p's range from < 0.001 to < 0.05; Brown, et al., 2005). Cronbach's α for the current study was 0.88.

Physical activity: Self-report. The Behavioral Risk Factor Surveillance System Physical Activity Module (BRFSS; see Appendix A) is part of a survey system designed by the United States Centers for Disease Control and Prevention (CDC). The surveillance system is a telephone-administered interview designed to collect data on chronic disease risk factors in individuals over age 18 (CDC, 2001). The interviewer asked respondents six questions about their weekly participation in moderate or vigorous activities in leisure, household, and transportation domains. Patients were guided to think about moderate activities (e.g., "brisk walking, biking, vacuuming, gardening, or any other activity that causes small increases in breathing or heart rate") and vigorous activities (e.g., "running, aerobics, heavy yard work, or any other activity that causes large increases in breathing or heart rate"). For each activity, patients reported the number of days per week and the total time per day they spend in the activities. Data obtained from the BRFSS included number of minutes per day spent in moderate physical activity and number of minutes per day spent in vigorous activity. The BRFSS indexed moderate and vigorous activities that occur for at least 10 minutes and leisure-time inactivity. The measure takes approximately five minutes to complete.

Studies have documented the reliability and validity of the BRFSS (Yore, et al., 2007). Test-retest reliability for moderate activity is acceptable (range of κ's = 0.35-0.53). For vigorous activity, test-retest reliability ranges (κ's) from 0.80 to 0.86. Validity (κ) of the questions compared to accelerometer data is 0.17 to 0.22 and compared to corresponding activity logs ranges from 0.40 to 0.52 (Yore, et al., 2007).

Physical activity: Behavioral measure. A pedometer is an objective measure of physical activity and movement. Some patients were provided with a pedometer (Yamax SW-701) to obtain a behavioral measure of physical activity. This Japanese-made pedometer meets the Japanese Industrial Standard set forth by the Ministry of Industry and Trading Regulations (Hatano, 1993), which require the pedometer to be accurate within 3% error 95% of the time. The SW-701 validly and accurately assesses number of steps taken in both laboratory (Crouter, Schneider, Karabulut, & Bassett, 2003) and free-living (Schneider, Crouter, & Bassett, 2004) studies. In these studies, the SW-701 calculates number of steps taken without significant difference from actual number of steps as observed in the lab or versus a well-validated criterion pedometer. Reliability of the SW-701 is excellent (Cronbach's α > 0.99) and its reliability compared to other established pedometers is also very high (> 0.99; Schneider, Crouter, Lukajic, & Bassett, 2003). Research shows pedometers validly assess number of steps per day for low weight, moderate weight, and overweight individuals (Swartz, Bassett, Moore, Thompson, & Strath, 2003). Patients were provided with a pedometer, study instructional guide, and daily log to record number of steps per day. The pedometer contains an internal recording device and the logs were to be used in the event of mechanical or user error.

Results

Power Analysis

Based on Cohen's (1992) conventions, *N* = 38 participants were needed to detect a large effect size. Based on this calculation, the current study is underpowered to detect effects.

Attrition

Following their catheterization, 87 patients gave initial permission to be contacted regarding possible participation in the study. Of these 87 individuals, 22 patients were excluded due to inclusion/exclusion criteria. The most common reasons for exclusion were diagnosis of percutaneous coronary intervention (*n* = 12), coronary artery bypass graft (*n* = 5), heart failure and pacemaker placement (*n* = 3), and no history of chest pain (*n* = 1). One patient disclosed a diagnosis of dementia and was excluded.

Upon initial telephone contact, 10 patients decided to no longer participate. An additional 10 patients were unable to be contacted. Of the remaining 45 patients who gave verbal consent to receive study materials, 16 did not return study materials and did not provide written informed consent. Of the remaining 29 patients who participated in the study, 20 completed the questionnaire battery and the phone interview, 8 patients completed the phone interview only, and 1 patient completed the questionnaire battery only. As proposed, this project included that patients complete a 7-day pedometer measure. Six patients returned pedometer data. Of these patients, 5 completed all 3 portions of the study, the questionnaire battery, the phone interview, and the pedometer.

The remaining patient who returned pedometer data completed the phone interview, but not the questionnaire battery. The pedometer data collection was terminated due to pedometers not returned by patients to issue to other patients.

Missing Data

Data were examined for missing items. To cope with missing items, mean imputation was utilized (at least 85% complete). Based on the 85% criterion, all patients who provided questionnaire data provided usable questionnaire data.

Descriptive Data

Patient demographics. In total, 29 patients participated in the study (see Table 1). The sample was comprised of more females (62%) than males (38%) with an average age of 55 years (*SD* = 8.30). The sample consisted of primarily Caucasian patients (69%) and African American patients (27.6%). Latino patients comprised 3.4% (1 patient) of the sample. The majority of the patients presented to the catheterization lab with a primary complaint of chest pain (*n* = 27). Heart burn and chest pain was the presenting complaint of one patient. The sample was comprised of individuals who completed some college or less education (65.5%). The remaining patients completed an associate's degree (3.4%), vocational training (13.8%), a bachelor's degree (10.3%), and post-graduate work (6.9%). Most patients were married (58.6%) and 20.7% were divorced. Family income was reported for 21 patients (8 had incomplete data). The most common household income was less than $15,000 (17.2%) and between $45,001-$60,000 (17.2%). Of the patients, 55.2% were employed fulltime, 17.2% were disabled, and 13.8% were retired.

Table 1

Patient demographics

Gender	*N*	Percentage
Female	18	62.1%
Male	11	37.9%
Total	29	100%
Age	***M***	***SD***
	55	8.30
Race	***N***	**Percentage**
Caucasian	20	69%
African American	8	27.6%
Latino	1	3.4%
Total	29	100%
Marital Status	***N***	**Percentage**
Never married	1	3.4%
Married	17	58.6%
Divorced	6	20.7%
Widowed	2	6.9%
Separated	2	6.9%
Cohabitating	1	3.4%
Total	29	100%
Level of education	***N***	**Percentage**
Less than high school	7	24.1%
12^{th} grade or GED	6	20.7%

Some college	6	20.7%
Vocational or trade school	4	13.8%
Associates degree	1	3.4%
Bachelors degree	3	10.3%
Post graduate degree	2	6.9%
Total	29	100%

Employment status	*N*	Percentage
Full-time	16	55.2%
Part-time	2	6.9%
Unemployed	2	6.9%
Disability	5	17.2%
Retired	4	13.8%
Total	29	100%

Income	*N*	Percentage
Less than $15,000	5	17.2%
$15,001-$30,000	2	6.9%
$30,001-$45,000	2	6.9%
$45,001-$60,000	5	17.2%
$60,001-$75,000	3	10.3%
Over $75,001	4	13.8%
Total	21(8 missing)	72.4%

Note. Total percentage for income does not equal 100% due to incomplete/missing items.

Description of heart disease risk factors. Rates of metabolic syndrome risk factors obtained in this study (obesity, diabetes, and hypertension) were examined. Body Mass Index (BMI), a measure of weight that accounts for height, classifies patients as ‘obese’ (BMI = greater than or equal to 30), ‘overweight’ (BMI = 25-29.9), ‘normal’ (18.5-24.9), or ‘underweight’ (BMI = 0-18.4). Most patients (64.3%) were classified as ‘obese’ with the average BMI score = 35.94 (*SD* = 10.68). Patients who fell within the ‘overweight’ category comprised 28.6% of the sample and 7.1% of the patients fell within the ‘normal’ weight range. The sample was examined for rates of hypertension and diabetes mellitus due to these factors contributing to the metabolic syndrome, which is highly correlated with later heart disease. Most patients (n = 22) carried a current diagnosis of hypertension (75.9%) and 9 patients (31%) were diagnosed with diabetes mellitus. The patients in this sample used an average of 6.24 daily medications (*SD* = 3.15; range = 1-11).

Chest pain: Syndrome duration and description. The majority of patients experienced episodes of chest pain for over 1 year (30%), followed by between 6 months and 1 year (20%), 1 month to 6 months (20%), more than 7 days (15%), and 7 days or less (15%). For most patients (71.4%), chest pain onset was described as ‘sudden’ and lasting 5-20 minutes (33.3%). Most patients (33%) experience their chest pain ‘never or rarely’ and the most common location of the pain is behind the breastbone (57%).

Pain anxiety: PASS. The PASS data were screened for normality. All 21 patients who provided PASS data provided usable data (at least 85% complete) and mean imputation was utilized to cope with any missing items. Data were screened for outliers visually through histograms and through a z score conversion (potential outliers +/- z =

3.29). These analyses revealed no outliers in the PASS data; skewness = -.003 and kurtosis = -1.31. The average score on the PASS was 75.25 (*SD* = 38.71). This is higher compared to a community sample (*M* = 65.04, *SD* = 29.07; Osman, Barrios, Osman, Schneekloth, & Troutman, 1994). These scores were higher compared to a sample of fibromyalgia patients (*M* = 68.4, *SD* = 32.9), lower compared to chronic low back pain patients (*M* = 84.7, *SD* = 37.7), and comparable to a more heterogeneous chronic pain patient group (*M* = 74.1, *SD* = 35.6; Roelofs et al., 2004).

Interoceptive fear: APPQ-I. The APPQ-I data were screened for normality. Data were screened for outliers visually through histograms and through a *z* score conversion (potential outliers ± *z* = 3.29). These analyses revealed no outliers in the APPQ-I data. The data was not significantly skewed (.47) or peaked (-.49). For the overall sample, the average score on the APPQ-I subscale was 10.62 (*SD* = 9.35). Scores ranged from 0-32. These scores are higher when compared to a sample of patients completing intake assessments at an anxiety disorders clinic (*M* = 5.00, *SD* = 7.44; Brown, et al., 2005).

Physical activity: BRFSS. Of the 29 participants, 28 patients completed the BRFSS physical activity module. Examination of these data show that 35.7% (*n* = 10) of the sample engaged in no leisure physical activity over the past month. The remaining 18 participants engaged in some form of physical activity. The BRFSS measures both moderate (activity that causes small increases in breathing or heart rate) and vigorous (activity that causes large increases in breathing or heart rate) physical activity. Of the total sample, 64.3% engaged in any moderate physical activity. Any vigorous activity was completed by 20.7% of the sample (*n* = 6). Upon initial examination of the data for outliers, 1 patient's data was an outlier both visually and by *z* score measures. This patient's BRFSS data were removed, resulting in a total of 27 participants' data being included this description of the sample (see Table 2).

Over one third of the overall sample engaged in no physical activity. The data were examined by both the amount of time spent in physical activity in minutes per week and categorically based on CDC guidelines of amount of physical activity for measurable health benefits. The following sections will describe these data in turn. The data output from the BRFSS is examined in number of minutes per week spent in moderate and vigorous physical activity for at least 10 minutes. Two primary scores were calculated for each participant: 1) Overall time (in minutes per week) spent in moderate and vigorous physical activity and 2) Adherence to CDC guidelines for sufficient physical activity. Overall time spent in physical activity was calculated by adding the moderate and vigorous activity scores together.

The CDC guidelines (2010) categorize physical activity levels based on sufficiency of physical activity for substantial and/or further health benefits. Substantial health benefits include lower risk for premature death, coronary heart disease, hypertension, stroke, type II diabetes, and depression (CDC, 2010). Further health benefits are based upon increasing physical activity levels to double the substantial guidelines per week and have additional benefits, including lower risk for colon cancer, breast cancer, and weight gain. For the current study, patients were grouped based on the substantial health benefits guidelines to include patients who are engaging in physical activity at a rate that in any way can measurably impact the important health outcomes listed above.

For the initial description and analysis, patients were divided into 3 groups based upon the CDC guidelines: No physical activity (*Inactive*), insufficiently physically active (*Insufficiently Active*), or sufficiently physically active (*Active*). Physical activity that is sufficient for substantial physical health benefits (*Active*) can be reached by patients in three different ways. First, patients are *Active* if they spend at least 150 minutes in moderate physical activity per week. Second, patients are *Active* if they spend at least 75 minutes per week engaged in vigorous physical activity. Third, patients are considered *Active* if they spend a combined total of at least 150 minutes per week in moderate physical activity plus vigorous activity per week multiplied by two (CDC, 2010). The CDC recommends that any physical activity for health benefits is completed over at least 3 days of the week. Any patients who participate in some physical activity, but failed to meet requirements for the *Active* group were considered to be *Insufficiently Active*. See Table 2 for average physical activity, medians, 95% confidence intervals, and groupings of patients based on CDC sufficiency guidelines.

Overall physical activity data: Including *Inactive* patients. The overall dataset visually appeared positively skewed on a histogram (skewness = 1.35; kurtosis = .41). The data were likely skewed due to the large proportion (37%) of the sample reporting no physical activity over the past month. For the overall sample, including *Inactive* patients, the mean number of minutes per week spent in a combination of both moderate and vigorous physical activity was 135.56 minutes (*SD* = 189.99; *Mdn* = 40; *95% CI* = 60.39-210.71; see Table 2). The maximum amount of time per week spent in a combination of moderate and vigorous activity was 555 minutes. The average amount of moderate activity in was 104.26 (*SD* = 144.05) minutes per week (range = 0-540). The average amount of vigorous activity per week was 31.30 minutes (*SD* = 80.31; range = 0-315). There was no significant relationship between physical activity and BMI, $r = -.16$, $p = .41$.

Sufficient physical activity. In the current patient group, 21 patients (78%) failed to meet CDC criteria for sufficient physical activity for substantial health benefits. Ten patients (37%) reported no leisure time physical activity compared to the CDC state population sample in which 27% of Missouri individuals reported no leisure time physical activity (CDC, 2010). In the NCCP patient group who completed any physical activity (weighted percentages), the 11 *Insufficiently Active* patients (65%; *M* = 84.55, *SD* = 69.15) compared to the 35% of the Missouri population who are insufficiently physically active. Of the six (weighted percentage = 35%) *Active* patients, 2 met the moderate activity guidelines with no vigorous activity present, 1 met vigorous activity with insufficient moderate activity, and 3 met the cut-off criteria for both moderate and vigorous activity. For the *Active* patients, the average number of minutes spent in physical activity was 455 (*SD* = 114.89). In the overall Missouri population, 65% of adults who engage in any physical activity are sufficiently physically active.

Table 2

Physical activity in NCCP patients

	PA in Minutes/Week			Median	95% CI	Sufficiency		
	N	*M*	*SD*			%I	%IS	%A
Total Sample[a]	27	135.56	189.99	40	60.39 - 210.71	37%	41%	22%
No PA = 37%	10					*N* =10	*N* =11	*N* =6
Only Any PA	17	215.29	201.03	135	111.93 - 318.66		65%	35%

Note. %I=% Inactive; %IS=%Insufficiently Active; %A=%Active, reported in weighted percentages.

[a]One outlier removed at this stage of analysis.

Psychiatric Comorbidity

The majority of patients met DSM-IV-TR diagnostic criteria for a current, clinically significant Axis I disorder (n = 21). Of these individuals, most patients had a principal diagnosis and one individual had a current Axis I diagnosis that was not classified as principal. Eight patients who completed the diagnostic interview did not meet criteria for a current Axis I disorder. A MANOVA (multivariate analysis of variance) revealed no differences in age, body mass index, presenting complaint, gender, level of education, marital status, or ethnicity based on current psychiatric disorder status (p's > .05). Interviewer diagnostic confidence ratings ranged from 75-95% (mode = 90%).

The most common principal Axis I disorder experienced by the patients was panic disorder without agoraphobia (n = 5; 17.9%). The other principal diagnoses are as follows: panic disorder with agoraphobia (n = 4; 14.3%), generalized anxiety disorder (n = 4; 14.3%), anxiety disorder, not otherwise specified (n = 4; 14.3%), major depressive disorder, single episode (n = 2; 7.1%), social phobia (n = 1), and no current Axis I principal diagnosis (n = 8; 28.6%). One patient carried a current Axis I diagnosis (caffeine-related disorder, NOS) without a current principal diagnosis. Clinical Severity Ratings (CSRs) were given to dimensionally determine the severity of the current principal diagnoses. Clinical significance is determined by a CSR of '4' or higher. Patients' principal Axis I disorder average severity for the current study was 4.87 (SD = 1.29). See Appendix B and Table 4 for measures stratified by psychiatric disorder status.

Primary Analyses

To examine the associations between interoceptive fear, fear of pain, and physical activity, Pearson's *r* correlations were calculated between APPQ-I scores, PASS scores, and number of minutes per week spent in physical activity. A low sample size ($N < 60$; Howell, 2002) can lead to unstable and highly variable correlations and these are interpreted with this precaution. Additionally, an examination of graphical representations of these data does not suggest a linear relationship due to the lack of variability from both a skewed dataset and few datapoints.

Hypothesis 1. A significant, negative correlation between interoceptive fear (APPQ-I) and physical activity (BRFSS number of minutes per week spent in physical activity) was hypothesized. When correlations were conducted including *Inactive* patients, the results failed to show a relationship between these variables, $r = -.14$, $p > .05$ (see Table 3). When *Inactive* patients were not included in the correlation, no relationship between interoceptive fear and physical activity emerged, $r = -.39$, $p > .05$. Thus, Hypothesis 1 was not supported.

Hypothesis 2. A significant, negative correlation between fear of pain (PASS) and physical activity (BRFSS number of minutes per week spent in physical activity) was hypothesized. Correlations that included the *Inactive* patients did not show the hypothesized relationship between the variables, $r = -.18$, $p > .05$ (see Table 3). When *Inactive* patients were removed from the analysis, the relationship remained non-significant, $r = -.30$, $p > .05$. Hypothesis 2 was not supported.

Table 3

Correlations among APPQ-I, PASS, and BRFSS (N = 20)

	APPQ-I	Physical Activity
Total sample (including ‘Inactive’)		
N = 20		
Physical Activity	-.14	
PASS	.35	-.18
Excluding ‘Inactive’		
N = 14		
Physical Activity	-.39	
PASS	.08	-.30

*Significant at $p < .05$.

Hypothesis 3. To examine the predictive value of interoceptive fear and fear of pain on physical activity after controlling for two key demographic variables, a hierarchical multiple regression was proposed. The assumptions of regression were not met. Regression assumes a normal distribution of data and this was violated both by a sample with a large proportion of patients who completed no physical activity and due to the low sample size which makes the regression unstable (Howell, 2002). An examination of residual plots revealed a non-linear relationship amongst the variables. Again, this was impacted by the skewed dataset and by the low *N*. The hierarchical multiple regression was performed as proposed and is included in Appendix C and Table 5 for the interested reader.

Discussion

Overview

The current study extends prior research to examine the relationship between interoceptive fear and anxiety on physical activity, which elicits feared cardiac-congruent sensations in NCCP patients. NCCP theories (Mayou, 1998; White & Raffa, 2004) assert that patients fear and avoid cardiorespiratory cues, though no published NCCP research has indexed daily life physical activity. The strengths of this study include stringent classification of the NCCP patient group through cardiac catheterization, reliable and valid questionnaire measures of interoceptive fear and pain anxiety, and the use of a valid and reliable interview of physical activity. In this section, the results of the study are briefly reviewed, clinical implications of physical activity in NCCP are discussed, and strengths and limitations of the study and future directions in NCCP research are outlined.

Results Review

Physical activity. The current study is novel in its examination of physical activity in NCCP patients. These data show that a large proportion of NCCP patients are completely inactive. Compared to the largely sedentary general U.S. population, there are an even greater proportion of NCCP patients who are inactive. Additionally, very few NCCP patients engage in physical activity that is sufficient to produce substantial health benefits, and a lower percentage of NCCP patients meet criteria for measurable health benefits compared to the overall state population.

Hypotheses 1. A significant, negative correlation between interoceptive fear and physical activity was expected. This effect was not observed and Hypothesis 1 was not supported. These results are interpreted cautiously due to the small sample size.

Hypotheses 2. A significant, negative correlation between pain anxiety and physical activity was expected. This effect was not observed and Hypothesis 2 was not supported. These results are interpreted cautiously due to the small sample size.

Hypothesis 3. A hierarchical multiple regression was proposed to examine the relationship between interoceptive fear and pain anxiety on physical activity after controlling for marital status and income. The data failed to meet critical assumptions of regression and did not yield the expected results. Residual plots lacked normality. The results of this regression were not significant and are included in Appendix C.

Physical Activity in NCCP Patients: Clinical Implications

This study contributes to the larger literature by indexing NCCP patients' physical activity levels. A large proportion of NCCP patients reported a lack of any physical activity and the majority of NCCP patients participate in physical activity at a rate and intensity that will not produce even the lowest level of cardiovascular benefits. Many NCCP patients do not engage their cardiovascular systems at clinically significant levels in daily life. This finding is consistent with lab results in which NCCP patients participate in exercise tolerance testing at a low intensity (Bradley, et al., 1992). Interoceptive fear of cardiac cues may be one reason for the low rates of physical activity in NCCP patients. Prior research indicates that the NCCP patient group is differentially vigilant to cardiac cues (Aikens, et al., 2001). In line with theories of NCCP, one mechanism of cardiac-specific interoceptive fear in NCCP may be through a conditioned fear of cardiovascular sensations. The current results did not yield the expected relationship between interoceptive fear, pain anxiety, and physical activity and possible reasons for the lack of an association are discussed further in the study limitations section. However, despite current study limitations, results show that these NCCP patients are insufficiently active for cardiac health.

NCCP patients may benefit from interventions that address chest pain from a cognitive and behavioral perspective. Recent research shows that it is necessary to specifically address cardiac anxiety for positive NCCP treatment outcomes (Spinhoven, Van der Does, Van Dijk, and Van Rood, 2010). Research has also shown that the relationship between cardiac anxiety and chest pain is mediated by interoceptive fear, highlighting that addressing the fear of bodily sensations is likely another important factor for NCCP interventions (White, et al., 2010). This early evidence suggests that the cognitive and physical experiences of cardiac anxiety are important to explore further as factors that perpetuate suboptimal health behaviors and poor quality of life for the NCCP patient. Additionally, early treatment research indicates that addressing cardiac anxiety is an important factor for clinical work and that behaviorally-based interventions are potentially important for positive overall health outcomes. Cognitive behavioral therapy (CBT) that incorporates exposure and desensitization to cardiorespiratory fears could be indicated for this patient group. Particularly, these strategies may be best implemented for the patients for whom behavioral avoidance is most salient. Identification of NCCP patients with cardiac-specific fears and behavioral avoidance is an area to be further elucidated in clinical research. Clinical research to examine the utility of interventions for NCCP patients that incorporate exposure and desensitization to chest pain sensations may be a promising area for alleviation of this persistent problem for many individuals.

Interventions that include modules to increase physical activity may have additional benefits beyond desensitization to cardiorespiratory cues. By promoting physical activity in this patient group, comorbid anxiety and mood symptoms may be positively impacted. Additionally, health prognosis and cardiac risk may be improved by focusing on these factors in clinical work with NCCP patients. Research has indicated a variable health prognosis for patients with NCCP, including a 4-year cardiac mortality rate that does not differ from patients with heart disease (Eslick & Talley, 2008), higher mortality rates compared to patients with no angina (Bodegard, Erikssen, Bjornholt, Thelle, & Erikssen, 2004), and high risk of cardiac events in older women (Robinson, et al., 2008). Some NCCP patients may be at increased risk for poor health outcomes due low levels of cardioprotective behaviors (i.e., physical activity) and high levels of cardiac risk behaviors, such as a sedentary lifestyle. The current study identifies that NCCP patients engage in sedentary lifestyles which serve to increase cardiac risk. Consequently, promoting physical activity in NCCP treatments could reduce cardiovascular risk.

Obesity. The high rates of obesity in this sample were considered in light of the low levels of physical activity. The obesity rates stimulate a causality debate: Do NCCP patients abstain from physical activity because they are obese or are NCCP patients obese because they do not engage in physical activity? Numerous studies cite negative correlations between BMI and physical activity (Brock, et al., 2009; Sharpe, Granner, Hutto, Ainsworth, & Cook, 2004); however, these associations appear to be the most salient for individuals at high activity levels. Specifically, physical activity is most influential in reducing BMI in individuals who engage in high levels of activity. Recent research shows that low levels of physical activity do not yield detectable changes in BMI (Hankinson, et al., 2010). Although most NCCP patients in this sample are obese, analyses revealed that BMI was not associated with physical activity output. The majority of the patients' activity levels are too low to impact weight, which could partially contribute to the lack of findings. Additionally, the CDC (2010) guidelines for the amount of physical activity that is necessary for cardiovascular health benefits is below what is required for weight loss. Very few NCCP patients in this sample engage in physical activity at a rate and intensity that is necessary for weight loss. This suggests that it is possible for patients to engage in sufficient physical activity for cardiovascular benefit and to be overweight or obese. It would not be expected that in a largely sedentary sample, such as the NCCP sample, BMI would be associated with physical activity. Longitudinal research is required to fully delineate causality in the presence of high obesity and sedentary lifestyle rates.

Obesity alone may not be a sufficient factor to explain the high rates of inactivity and insufficient physical activity, but possible interaction effects should be explored in future research. Smits and colleagues (2010) found that individuals with higher BMI coupled with higher rates of anxiety sensitivity engaged in less physical activity during a laboratory treadmill test. It may be that interaction of factors such as interoceptive fear, avoidance, and BMI lead to lower physical activity output within the NCCP population. Disentangling these factors would be important to elucidate the most efficient ways to intervene clinically.

Strengths and Limitations

Cardiac inclusion criterion. NCCP outcome literature yields a mixed prognosis and different cardiac inclusion criteria may be one reason for inconsistencies. A strength of the current study is the stringent cardiac inclusion criterion. Cardiac catheterization is an improvement given that it is the gold-standard diagnostic procedure for coronary artery disease (CAD). The NCCP patients in this study can be classified even more narrowly as non-CAD patients. Compared to prior research that uses other cardiac inclusion criteria (i.e., questionnaire-based data, exercise tolerance testing), the current sample clearly does not meet criteria for CAD and can be considered to lack cardiac diagnosis with high confidence.

It was considered that the cardiac catheterization criterion could have contributed to the high rates of obesity in this NCCP sample. When cardiac evaluation procedures are selected, they are based upon a variety of factors that are associated with overall cardiac risk and quality of pain. However, the literature suggests that obese patients are often less likely to be referred for cardiac evaluation. Research indicates that some morbidly obese and obese patients may be less likely to be referred for cardiac catheterization due to image acquisition difficulties stemming from adiposity, instrumentation guidelines (i.e., tables with weight limits), and procedural risks (Kearn, 2008).

Measures. An additional strength of the current study is the use of empirically-validated measures. Although measuring physical activity is a challenge and will be discussed in more detail in the following section, the BRFSS physical activity module has been empirically validated. An additional strength is that the BRFSS is a widely-used measure with datasets by state for comparison.

Sample size and design. The sample size is suboptimal and renders these results suspect to bias. Correspondingly, the results in this study should be extrapolated with extreme caution. The central limit theorem asserts that stable means are developed at N = 30 (Howell, 2002); therefore, any parametrically-derived results from this study lack robustness because even a few data points could significantly impact the mean. Further, to complete stable correlations (2 means), N = 60 is desirable. Likely, the small sample size at least partially contributed to the data's nonlinearity, which makes the linear regression equation inadvisable. Due to the concomitant assumption violations for various tests, the small sample size is a limitation of this study. Additionally, the design of the study makes it impossible to know the factors that caused the observed low levels of physical activity.

Physical activity measurement difficulties. Physical activity can be measured via self-report and direct, behavioral methods. Each of these measurements has positive and negative aspects, but self-report is perhaps the less desirable method for several reasons. One common complaint regarding self-report physical activity is its failure to detect light to moderate physical activity (Tudor-Locke & Myers, 2001). The BRFSS physical activity module attempts to account for this shortcoming by including a section on moderate activity.

One of the common indicators of physical activity in typically sedentary populations is walking and this is problematic because walking is believed to be the least reliably recalled physical activity (Ainsworth, Leon, Richardson, Jacobs, & Paffenbarger, 1993). Biases such as social desirability may contribute to unreliable reports of walking behaviors; however, recall bias is likely impactful as well. There exists inherent difficulty in recalling behaviors, specifically for moderate physical activity. The most accurate measure of physical activity is direct measurement with pedometers or accelerometers (Tudor-Locke & Myers, 2001).

To mitigate the shortcomings of self-report of physical activity, pedometer data were collected. Unfortunately, the pedometers were not returned at an early phase of data collection. Retrospectively, several design considerations may have led to better pedometer response rate. Although not possible in the current study, behavioral measures that require instrumentation that needs to be returned may be best managed through follow-up appointments. The cardiac catheterization procedure is a single time point procedure performed by a sub-specialty provider. Further cardiac care is provided by referring medical providers. The pedometer return would have likely benefitted from a follow-up, in-person appointment at which the device could be collected. Secondly, the pedometers utilized in this study met gold-standard requirements for measurement and were also extremely user-friendly. It could be that a less accessible device that was less utile to the patient may have facilitated return. Finally, a device that could remotely send data back to the study would be ideal. This way, patients would not bear the burden of returning the device. These options would have likely facilitated data collection, but the nature of cardiac catheterization and budgetary constraints precluded these options.

Physical activity: An inherently skewed construct. Physical activity rates were skewed due to the large number of participants who engaged in no physical activity. In the general population, physical activity rates are also skewed in this direction. Researchers have coped with this data in several ways. Data transformations (e.g., square root transformations) can be performed to statistically work with skewed data; however, this is undesirable due to interpretation difficulties. Another approach that is utilized by researchers is the creation of discrete categories upon which further analyses can be derived. For physical activity, this technique is supported by recent research that suggests that a categorical system to account for both frequency and duration of physical activity over longer periods of time may best capture the construct (Seelig & Fuchs, 2011). After separating into CDC-defined groups of physical activity, a logistic regression was considered; however, due to the small cell size of *Active* patients, this test was not indicated. With additional data, logistic regression may be a viable option. Finally, newer statistical techniques, such as bootstrapping, which does not adhere to the assumptions of normal distributions and is particularly recommended in populations that are not expected to have normal distributions, could be utilized in order to include *Inactive* patients in these analyses.

Future Directions

In the current study, physical activity was indexed exclusively through a self-report measure. Although the use of an empirically studied measure is a strength of the study, the research could be bolstered by a behavioral measure of physical activity.

Recent studies have shown that non-clinical individuals with high body mass and greater fear of somatic sensations has lower output on a laboratory treadmill test of physical activity (Smits, Tart, Presnell, Rosenfield, & Otto, 2010). Future direct, behavioral research on physical activity in NCCP patients could serve to examine the possible relationship between physical activity and fear of cardiac symptoms. The correlational design of the current study precludes any causal attributions that can be derived from these results. Thus, the reasons for low rates of physical activity can be discussed and theorized, but conclusions regarding the causes of sedentary lifestyle in the NCCP population are beyond the scope of the present study. Longitudinal research is needed to examine the role of physical activity and cardiovascular risk in NCCP.

Factors that best inform intervention with individual NCCP patients have not been identified. Burgeoning clinical research with NCCP patients confirms the importance of specific focus on cardiac cues. This heart-focused attention appears to be at the crux of clinical intervention with NCCP patients. It may be that there are subgroups and individual differences within the NCCP population for whom specific aspects of interventions are best indicated. Future research to examine the causal factors for the low rates of physical activity in NCCP patients is needed to best develop interventions to promote physical and psychological health.

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Appendix A: BRFSS Physical Activity Module

Sedentary Lifestyle: During the past 30 days, other than your regular job, did you participate in any physical activities or exercise, such as running, calisthenics, golf, gardening, or walking for exercise?

Lead in: We are interested in two types of physical activity, vigorous and moderate. Vigorous activities cause large increases in breathing or heart rate while moderate activities cause small increases in breathing or heart rate.

1. Now thinking about the physical activities you do (when you are not working) in a usual week, do you do moderate activities for at least 10 minutes at a time, such as brisk walking, bicycling, vacuuming, gardening, or anything else that causes small increases in breathing or heart rate?
2. How many days per week do you do these activities for at least 10 minutes at a time?
3. On days when you do moderate activities for at least 10 minutes at a time, how much total time do you spend doing these activities?
4. Now thinking about the vigorous activities you do (when you are not working) in a usual week, do you do vigorous activities for at least 10 minutes at a time, such as running, aerobics, heavy yard work, or anything else that causes large increases in breathing or heart rate?
5. How many days per week do you do these activities for at least 10 minutes at a time?
6. On days when you do vigorous activities for at least 10 minutes at a time, how much total time do you spend doing these activities?

Appendix B: Measures Stratified by Psychiatric Disorder Status

The PASS scores were stratified by current psychiatric disorder status. The 15 patients who completed the PASS data and have current Axis I diagnoses reported higher scores on the PASS (*M* = 74.97, *SD* = 35.10) compared to the 5 patients who have no current Axis I diagnosis and completed the PASS (*M* = 64.94, *SD* = 47.67). An ANOVA examined group differences on the PASS based upon psychiatric disorder status and revealed commensurate PASS scores between the groups, $p = 0.62$.

The APPQ-I scores were indexed by psychiatric comorbidity status. An ANOVA revealed that patients with comorbid Axis I disorders ($n = 15$) reported higher interoceptive fear on the APPQ-I (*M* = 11.46, *SD* = 8.31) compared to patients ($n = 5$) without comorbid Axis I disorders (*M* = 3.8, *SD* = 4.55), with a result that approaches significance, $F(1, 18) = 3.78$, $p = 0.068$.

The impact of psychiatric disorder status on physical activity levels was examined utilizing the overall sample and by examining only individuals who completed any physical activity (See Table 4). Two additional outliers were removed. In patients with psychiatric disorders, 47% engaged in no physical activity and 52% engaged in some form of physical activity. In patients without current psychiatric disorders, 86% engaged in some physical activity over the past month. Due to the high proportion of patients with Axis I diagnoses who engaged in no physical activity, the data was significantly positively skewed (2.53) and peaked (7.04). Of patients with Axis I disorders, 1 patient (5%) met CDC criteria for sufficient physical activity; 18 (95%) did not meet criteria for sufficient physical activity. This is in comparison to the patients who did not have current

Axis I disorders, 4 (57%) met CDC criteria for sufficient physical activity and 3 (43%) did not.

In order to examine the data in a more reliable manner, a Kolmogorov-Smirnov *Z* test was conducted to compare physical activity rates between patients with comorbid Axis I disorders and patients without comorbid Axis I disorders. This non-parametric test utilizes less restrictive assumptions than parametric testing by ranking data to test two independent samples (Axis I comorbidity). In particular, it was chosen because it is the most powerful non-parametric test to utilize when comparing samples with small sample sizes (Field, 2009). The Kolmogorov-Smirnov *Z* test revealed that NCCP patients with comorbid Axis I disorders spend significantly less time in physical activity than patients without comorbid Axis I disorders, $p < .04$.

Table 4

BRFSS physical activity (PA) stratified by Axis I disorder status

	PA in Minutes/Week			Median	95% CI	Sufficiency		
	N	*M*	*SD*			%I	%IS	%A
Psychiatric Disorder Status[a]								
Current Axis I	19	48.42	72.78	10	13.29 - 83.55	47%	47%	5%
No PA = 47%	9							
Only PA	10	92.00	78.54	75	35.82 - 148.18		90%	10%
No Current Axis I	7	322.86	286.08	360	104.52 - 541.19	14%	29%	57%
No PA = 14%	1							
Only PA	6	376.67	206.29	442.50	160.18 - 593.16		33%	67%

Note. %I=% Inactive; %IS=%Insufficiently Active; %A=%Active, reported in weighted percentages. Percentages not equaling 100% are due to rounding.

[a]Two outliers removed at this stage of analysis.

Appendix C: Linear Regression

For the interested reader, a hierarchical linear regression was performed as proposed to examine the impact of pain anxiety (PASS total score) and interoceptive fear (APPQ-I) on physical activity (time per week) after controlling for 2 variables (marital status and income). Marital status and income were entered into Block 1 and PASS total score and APPQ-I were entered into Block 2. The assumptions of regression were examined prior to the analysis and were violated; therefore, these analyses are not considered to be robust and are outlined in this appendix.

The assumptions of linear regression were examined. There was a nonlinear relationship amongst the variables. The residuals were not normally distributed. The sample size included in the regression (n = 20) was quite low. These violations make the regression largely uninterpretable and results showed no significant relationships among the variables.

After entering marital status (β = -.04) and income (β = .43), these variables were not significant predictors of physical activity, R^2 = .20, F(2,17) = 2.13, p = .15 (see Table 5). The model was not improved by adding the predictor variables: PASS (β = .13) and APPQ-I (β = -.17), ΔR^2 = .02, F(4,15) = 1.07, p = .41. The partial correlation (.11) between PASS and physical activity was not significant, p = .66. The partial correlation (-.15) between APPQ-I and physical activity was not significant, p = .56.

Table 5

Regression: Pain anxiety and interoceptive fear on physical activity after controlling for marital status and income (N = 20)

	b	*SE b*	*β*
Block 1			
Constant	-2.95	199.79	
Marital Status	-8.71	53.93	-.04
Income	44.62	26.23	.43
Block 2			
Constant	-122.67	308.06	
Marital Status	18.32	70.80	.09
Income	56.92	35.26	.54
Interoceptive Fear	-3.95	6.67	-.17
Pain Anxiety	.66	1.48	.13

Note. R^2= .20 for Step 1, ΔR^2 = .02 for Step 2.

*Significant at $p < .05$.