INTERNALIZING SYMPTOMS AND FUNCTIONAL DISABILITY IN CHILDREN WITH NONCARDIAC CHEST PAIN AND INNOCENT HEART MURMURS

By

JENNIFER L. LEE

(Under the Direction of RONALD L. BLOUNT)

ABSTRACT

Objective: To examine the occurrence of internalizing symptoms and functional disability in children with noncardiac chest pain (NCCP) compared to children with innocent heart murmurs (IHM). Method: Sixty-seven children with NCCP and sixty-two children with IHM were recruited from the pediatric cardiologist’s office. Children and parents completed measures of psychological functioning and functional disability during a first visit to the cardiologist, and prior to diagnosis. Results: Children with NCCP reported greater levels of internalizing symptoms than children with IHM. Parents of children with NCCP and IHM reported similar levels of anxiety and depression for their children. Children with NCCP and their parents reported greater levels of functional disability than children with IHM and their parents. Conclusion: Children with NCCP experience greater levels of psychosocial distress and impairment than a similarly healthy sample of children with IHM. Consideration of psychosocial influences on NCCP would likely be beneficial for assessment and treatment.

INDEX WORDS: Internalizing symptoms, Noncardiac chest pain, Functional disability
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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>iv</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>vi</td>
</tr>
<tr>
<td>CHAPTER</td>
<td></td>
</tr>
<tr>
<td>1 INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>2 METHOD</td>
<td>10</td>
</tr>
<tr>
<td>3 RESULTS</td>
<td>16</td>
</tr>
<tr>
<td>4 DISCUSSION</td>
<td>20</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>26</td>
</tr>
</tbody>
</table>
## LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 1</td>
<td>Demographic Information</td>
<td>15</td>
</tr>
<tr>
<td>Table 2</td>
<td>Between Groups ANCOVA</td>
<td>19</td>
</tr>
</tbody>
</table>
CHAPTER 1

INTRODUCTION

Nearly 10% of all school-age children experience chest pain, a common presenting symptom in children seeking health care services (Garber, Walker, & Zeman, 1991; Selbst, Ruddy, Clark, Henretig, & Santilli, 1988). In at least 80% of pediatric patients seeking medical evaluation, no cardiac etiology for the pain is found, and the patient receives a diagnosis of noncardiac chest pain (NCCP; Lam & Tobias, 2001; Massin et al., 2004). NCCP is the most frequently given diagnosis for complaints of pediatric chest pain (Selbst, Ruddy, & Clark, 1990; Tunaoglu et al., 1995; Veeram Reddy & Singh, 2010). Chest pain is also a persistent problem, with several investigations indicating that chest pain continues in the majority of children for 1 to 3 years following the initial diagnosis (Lam & Tobias, 2001; Lipsitz et al., 2004; Selbst et al., 1990).

Considering the prevalence and duration of NCCP, elucidating the factors surrounding its occurrence is a necessary pursuit, but one that is not adequately addressed in the literature. Because a cardiac disorder is not the cause of NCCP, the question remains as to the possible origins of these children’s experiences of pain and pain-related disability. Thus far, the pediatric medical literature has focused primarily on alternative physical conditions that may contribute to the perception of pain in the child’s chest. However, according to the biopsychosocial theory of pain, the biological origin of the pain may not be the most critical area for examination, as psychological and social factors also contribute to the occurrence and maintenance of pain and pain-related disability (Gatchel, Peng, Peters, Fuchs, & Turk, 2007). Psychological and social
factors may have a primary, causal contribution to NCCP; or there may be disturbances in psychological and social functioning that are secondary to and produced by NCCP. Even if psychosocial distress is secondary to pain that has a clear physical etiology, psychosocial factors may play a role in exacerbating or maintaining the condition. Support for these relationships has been found in adults diagnosed with NCCP, but psychosocial factors have yet to be investigated thoroughly in children with NCCP (Thurston et al., 2001). Some of the more commonly occurring physical factors that may contribute to NCCP will be reviewed below, followed by a review of psychological factors that are associated with NCCP.

**Physiological Factors and NCCP**

In adults, chest pain frequently has a cardiac etiology. However, in children and adolescents, a cardiac etiology for chest pain is found in only 2 to 5 percent of cases presenting to pediatric primarily care physicians (PCP) and 3 to 7 percent of those presenting to cardiology clinics (Thull-Freeman, 2010; Thurston et al., 2001). These slightly differing percentages are analogous to data from the study of children with recurrent abdominal pain (RAP), a functional pain disorder. Children with RAP who were seen at a gastroenterology specialty clinic reported more severe, more frequent, and longer lasting pain than those presenting at a PCP (Robins, Price, & Proujansky, 2002). It is likely that the most severe cases of chest pain are referred to cardiology specialty clinics, where cardiac etiologies are most frequently found.

Two recent reviews on pediatric chest pain suggest several plausible biological influences: musculoskeletal/chest wall, respiratory/pulmonary, gastrointestinal (GI), idiopathic/unknown, and psychological (Thull-Freeman, 2010; Veeram Reddy & Singh, 2010). Musculoskeletal/chest wall influences can often be attributed to costochondritis, which is the presence of sharp pains in the costochondral joints, the cartilaginous connections between the
ribs, that usually last a few seconds to a few minutes without any signs of inflammation. The pain can be reproduced during a physical exam with palpitation. Tietze syndrome, a specific form of costochondritis localized usually to a single joint, is characterized by the presence of pain and inflammation in a specific joint and is also considered to be musculoskeletal. The etiology of costochondritis in children is also not well understood. Musculoskeletal influences can also be due to injury or muscle strain, although these individuals rarely present to the cardiologist, but instead they are usually seen by the emergency department (ED) or PCP (Leung, 2004; Massin, et al., 2004). Musculoskeletal influences are diagnosed in 1 to 89 percent of all children seen in cardiology clinics (Thull-Freeman, 2010; Veeram Reddy & Singh, 2010). Treatment for musculoskeletal influences includes reassurance that the origin is benign, rest, and with more severe reports of pain, analgesic agents such as nonsteroidal anti-inflammatory drugs (e.g., ibuprofen).

In 1 to 12 percent of children presenting to cardiology clinics, a respiratory etiology for NCCP is identified. Bronchial asthma is the most common respiratory etiology and is usually treated with inhaled bronchodilators. Gastrointestinal (GI) influences are identified in 3 to 12 percent of children. The most common GI etiology identified is gastroesophageal reflux disease, which is characterized by a burning pain in the epigastric area of the chest. Typical treatment involves proton pump inhibitors. In the remaining 37 to 54 percent of children seen in cardiology clinics, the physiological influences of the pain are labeled as idiopathic, or unknown. In contrast to those who are thought to have a primarily physiological etiology for chest pain, 4 to 19 percent of individuals with NCCP are thought to have primarily psychological influences for the occurrence of NCCP. Anxiety, panic disorder, and conversion disorder are some of the formal psychological diagnoses identified as sources of the chest pain within the medical
literature. Difficulty breathing, dizziness, and paresthesias often accompany psychogenic chest pain. Thus, in the literature that is published primarily in medical journals (Thull-Freeman, 2010; Veeram Reddy & Singh, 2010), alternative noncardiac, physical causes are identified in a number of instances of NCCP, a large percentage of causes are of unknown or idiopathic origin, and psychological factors are considered in only 4-19% of the cases. In some reviews (Veeram Reddy & Singh, 2010), psychosocial etiologies or contributing factors may be mentioned only under the heading of miscellaneous factors. This current medical conceptualization of NCCP appears to be limited and focused almost exclusively on alternative biological explanations. Although physiological influences may be identified that contribute to NCCP, the biopsychosocial theory of pain (Gatchel, et al., 2007) emphasizes that psychosocial factors must also be examined to better understand the presentation of NCCP in children and adolescents, as the combination of these factors may influence the perception, appraisal, and experience of pain.

**Psychological Factors and NCCP**

Several psychological factors have been found to be associated with NCCP. The most prevalent factors that have been studied thus far are subsumed under the internalizing types of symptoms (Kamphaus, Distefano, & Lease, 2003), including anxiety, depression, anxiety sensitivity, and somatization, or the presence of additional somatic complaints. Some reports in the pediatric literature suggest that somatic complaints such as chest pain may actually be the most common manifestation of psychosocial distress in pediatric settings (Campo & Fritsch, 1994). Gilleland and colleagues (2009) found that children’s self-reported levels of chest pain were positively associated with higher rates of additional somatic symptoms. These findings suggest noncardiac chest pain may be a part of an overall constellation of somatic symptoms experienced by these children. Brenner, Ringel, and Berman (1984) described NCCP as
“psychogenic” and propose the pain could be evidence of a somatoform disorder. However, rather than thinking dichotomously in terms of a diagnosable somatoform disorder, it may be more useful to think in terms of a continuum of somatic responding, with subclinical somatic sensitivity also being associated with NCCP. In support of NCCP as a part of a larger pattern of somatic symptoms, Santalahi, Aromaa, Sourander, Helenius, and Piha (2005) found that the occurrence of one somatic symptom predicts the occurrence of additional somatic symptoms in their longitudinal study.

NCCP has been linked to numerous psychosocial factors. Anxiety sensitivity, often defined as the “fear of fear,” represents a particular cognitive vulnerability to the development of anxiety symptoms through heightened interoceptive awareness. Children with increased anxiety sensitivity perceive changes in autonomic symptoms (e.g. racing heartbeat, trembling hands) with greater sensitivity and make catastrophic attributions about these sensations as being dangerous or harmful (Eley, Stirling, Ehlers, Gregory, & Clark, 2004; Kearney, Albano, Eisen, Allan, & Barlow, 1997). As applied to NCCP, it is possible that children with high anxiety sensitivity are more perceptive of symptoms of chest pain and would make catastrophic interpretations about the consequences of these physical sensations, regardless of the actual cause of the pain. In support of this, Gilleland et al. (2009) found that fear of physiological arousal, a component of anxiety sensitivity, was associated with more severe chest pain. Previous research on NCCP suggests that 1 to 3 years after diagnosis in a cardiology clinic, children with NCCP report more current symptoms of anxiety sensitivity, as well as fear of physiological arousal, when compared to other healthy children with innocent heart murmurs (Lipsitz et al., 2004). An innocent heart murmur (IHM) is a cardiac abnormality that causes an unusual sound in the heart rhythm. The condition is benign and requires no treatment, no
activity or exercise limitations, and often resolves over time (National Institutes of Health, 2008). Anxiety sensitivity and catastrophic attributions have been found in other pain populations to be related to levels of disability experienced by children and adults, even when controlling for severity of pain (Lynch, Kashikar-Zuck, Goldschneider, & Jones, 2006; Plehn, Peterson & Williams, 1998). In this manner, anxiety sensitivity may play a particularly salient role in the development and maintenance of NCCP.

In addition to anxiety sensitivity, other internalizing symptoms also have been consistently associated with recurrent functional pain in children and adolescents. In almost all of these investigations, assessment of psychosocial functioning occurred months to years following the diagnosis of NCCP, with little study of patients’ psychosocial functioning at the time of their cardiology evaluation. In their first investigation, Lipsitz et al. (2004) found elevated anxiety and, in particular, physical anxiety in youngsters with NCCP when compared with children who had been diagnosed with innocent murmurs. In a later study, these investigators found 56% of the children with NCCP met DSM-IV criteria for an anxiety disorder, with panic disorder being the most frequent type. Panic disorder shares some common symptoms with NCCP, including possible chest pain, chest tightness, and catastrophic interpretation or fear that their symptoms may lead to death or injury (Eley et al., 2004; Lipsitz et al., 2005). Using an unstructured interview, Tunaoglu et al. (1995) found psychiatric symptoms in 75% of children with NCCP, with anxiety being the most prevalent symptom. Although levels of depressive symptomatology were not elevated in some studies (Gilleland et al., 2009; Lipsitz et al., 2004), Yildirim et al. (2004) found 10% of the children with NCCP in their study met diagnostic criteria for depression. More research on the possible contribution of depressive
symptoms in NCCP is needed to determine if depressive symptoms consistently present in children with NCCP.

An important factor that has been studied in other persistent pediatric pain conditions, but not in children with NCCP, is functional disability. Functional disability refers to the inability to participate in everyday activities due to physical symptoms. These physical symptoms may be due to a clear physical illness or disorder, or associated with conditions which have a prominent psychological component. Functional disability is a complex and multidimensional construct that has been measured in a variety of ways. In adults, disability has primarily been measured by indices such as impaired social functioning and lost wages from the inability to work. For school-aged populations, missed days of school and low involvement in social and extracurricular activities have previously served as indicators of functional disability (Lynch et al., 2006; Gil et al., 2003). There are also standardized indices (Walker & Green, 1991) of functional disability on which ratings are assigned based on the degree to which the persons’ condition interferes with their ability to perform activities such as being able to walk up stairs, eat regular meals, or walk the length of a football field. For children with NCCP, assessing impairment using standardized indices, as well as involvement in school activities should be conducted to evaluate the extent of functional disability associated with this condition.

Current Study

The goal of the current study was to evaluate the differences in several domains of psychosocial functioning for children with NCCP versus those with innocent heart murmurs (IHM). Most prior research has assessed psychosocial functioning in children months to years following their diagnosis with NCCP. In some of these studies, an IHM comparison group was incorporated. Unique to this investigation, the psychological functioning of two groups of
children, those who receive diagnoses of either NCCP or IHM, was assessed at the time of the cardiology clinic visit, and prior to receiving their diagnostic feedback. Thus, assessment of the two groups was standardized according to an important medical event, the cardiac diagnostic evaluation. Murmurs are the most frequent cause for referral to a cardiologist by a pediatrician, although most murmurs are identified in early childhood and resolve by adolescence (Geggel et al., 2002). For both groups of children, the diagnostic process typically includes an initial exam by the pediatrician and referral to a pediatric cardiologist. At the cardiologist’s office, the visit includes the collection of family and medical history, physical exam, electrocardiogram (EKG), and possibly an echocardiogram if deemed necessary by the cardiologist (Evangelista, Parsons, & Renneburg, 2000; Thull-Freeman, 2010). Aside from having procedurally similar visits, children with IHM made a better comparison sample than a community sample as they help to control for the anxiety that may be experienced merely as a result of a referral and evaluation by the cardiologist due to an undetermined medical condition (Geggel et al., 2002).

The two groups differed however, in that children with NCCP volunteered that they had chest pain, and that report eventually lead to a referral. Thus, in the case of NCCP, the child’s and family’s attentional and interpretation processes influence initiation of referral for medical evaluation and possible intervention. In contrast, children and adolescents with IHM were told by a physician that their heart is making an unusual sound and a referral for further evaluation was needed. Although NCCP and IHM are considered to be benign diagnoses, neither patient group knew that they had a benign condition at the time of clinic evaluation and completion of psychological inventories.

Variables assessed in this investigation included anxiety, anxiety sensitivity, and depression. This investigation extends prior research by examining these variables at the time of
the cardiology evaluation rather than retrospectively. Unique to this investigation, and in accordance with prior research suggesting that NCCP is part of a more global pattern of somatization (Gilleland et al., 2009), reports of additional somatic symptoms in the children were evaluated and compared to patients who have been diagnosed with IHM. Further, having been established as a critical factor for exploration in children with pain, differences in functional disability for the two patient groups were assessed through self- and parent-report standard indices, school absences, and the children’s reported extracurricular involvement. It was hypothesized that children with NCCP would have higher levels of somatic symptoms and functional disability, as well as higher levels of depression, anxiety, and anxiety sensitivity than were found in children with IHM.
CHAPTER 2

METHOD

Participants

Participants included 67 children and adolescents diagnosed with NCCP and 62 with innocent heart murmurs (IHM). Children ranged from 8 to 18 years old. Demographic information is presented in Table 1. Approximately 18 potential participants (14%) declined participation due to time demands or for unknown reasons. Exclusion criteria were non-English speaking parents or children (N=1), guardian not present at the time of the evaluation (N=1), incomplete measures (N=12), child over the age of 18 (N=1), having a prior diagnosis of a medical disorder that could account for the child’s physical symptoms and disability (N=2 children with cerebral palsy referred for chest pain), receiving a diagnosis during the current visit of a cardiac condition that was not benign (N=6 who were referred for murmur evaluation), not receiving a definitive diagnosis at the end of the cardiac evaluation (N=4 who were referred for chest pain), or complaining of chest pain during a murmur evaluation (N=1). Children with a dual diagnosis of an innocent heart murmur and noncardiac chest pain were retained in the chest pain group if the referral was for symptoms of chest pain, and an IHM was found for the first time during the cardiology evaluation (N=2).

Procedures

Participants were recruited from three outpatient cardiology clinics in the Southeastern United States. All participants were first-time patients to the cardiologists’ office. Upon entering the cardiologists’ office, individuals referred by the pediatrician for chest pain or heart
murmur evaluations were approached by a researcher to participate in the study. Informed consent for parents and assent for children was obtained, along with Health Information Portability and Accountability Act (HIPAA) release prior to participating. Children and adolescents completed the measures during the office visit before receiving diagnostic feedback from the cardiologist. Measures included demographic information and self-report inventories. Medical chart review was conducted to determine diagnosis and relevant medical history for exclusionary purposes. Only children and adolescents with a diagnosis of NCCP or an IHM were retained in the database. Institutional Review Board approval for the study was obtained from the investigating university and medical school.

**Instruments**

Measures included in the study were self-report questionnaires. Children completed measures of functional disability (FDI-C), somatic symptoms (CSI-C), depression (CDI), anxiety (MASC), and anxiety sensitivity (ASIC). Parents completed measures of the child’s functional disability (FDI-P), internalizing symptoms (BASC-2), somatization (CSI-P), and demographics, as well as reported on the child’s school attendance, and participation in school and extracurricular activities.

*Functional Disability.* The Child-Report and Parent-Report versions of the Functional Disability Inventory (FDI-C, FDI-P; Walker & Green, 1991) were completed to assess the extent to which the child’s physical symptoms had impaired their participation in every day activities during the past two weeks (e.g. making it through the day without a nap, running the length of a football field). Fifteen items were rated on a 5-point Likert scale from 0 – “Not at all” to 4 – “A whole lot.” The FDI has established internal consistency with Cronbach’s alpha of .86 – .91, as well as established reliability and validity. Cronbach’s alpha for our sample was .90 for the FDI-
P and .84 for the FDI-C. As an additional measure of functional disability, parents reported the number of partial and complete school days their child missed during the past twelve months. Parents also rated their child’s involvement in extra-curricular activities on a scale from 1 – “Not at all active” to 3 – “Very active.”

**Child Somatization Inventory (CSI).** The CSI – Parent and Child Report versions (CSI-C, CSI-P; Garber, et al., 1991) were completed to assess how much the child was bothered by 35 somatic complaints (e.g. stomach ache, joint pain) over the past two weeks. Each symptom was rated on a 5-point Likert scale from 0 – “Not at all” to 4 – “A whole lot.” The CSI has established test-retest reliability, acceptable construct validity, and an internal consistency of .92 in a community sample (Garber, et al., 1991; Walker & Garber, 2003). For our sample, Cronbach’s alpha was .80 for the CSI-P and .90 for the CSI-C.

**Children’s Depression Inventory (CDI).** The CDI (Kovacs, 1992) is a 27-item child self-report inventory designed to measure the presence and severity of depressive symptoms. Each item provides three statements for endorsement. The child selects the item that most describes them during the past two weeks. The self-report statements are scored as 0 (absence of symptom), 1 (mild or probable symptom), or 2 (definite symptom) with total scores ranging from 0-54, higher scores being indicative of a higher level of symptoms. Normalized t-scores were used in analyses for this study. The CDI has been shown to have good internal consistency at a Cronbach’s alpha of .86, as well as good convergent and discriminant validity (Craighead, Curry, & Ilardi, 1995; Kovacs, 2003). Cronbach’s alpha for total depressive symptoms in our sample was .88. For the five factors of the CDI, Cronbach’s alpha was .76 for Negative Mood, .60 for Interpersonal Problems, .56 for Ineffectiveness, .71 for Anhedonia, and .64 for Negative Self-Esteem.
**Multidimensional Anxiety Scale for Children (MASC).** The MASC (March, 1997) will be completed by the child to assess major dimensions of anxiety symptomatology. The self-report MASC consists of 39 items with a 4-point Likert scale. Children and adolescents endorse the extent to which statements are 0 – “Never true about me” to 3 – “Often true about me.” Normalized t-scores were used in analyses. Satisfactory internal consistency and reliability have been reported (March, Sullivan, & Parker, 1999; Rynn et al., 2006). Cronbach’s alpha for our sample was .87 for the total score. Internal consistency for the four factors and accompanying components of the MASC was .82 for Physical Symptoms encompassing .75 for both Tense/Restless and Somatic/Autonomic, .77 for Harm Avoidance encompassing .61 for Perfectionism and .73 Anxious Coping, .82 for Social Anxiety encompassing .87 for Humiliation/Rejection and .61 for Performance in Public, and .62 for Separation Anxiety/Panic.

**Anxiety Sensitivity Inventory for Children (ASIC).** The ASIC (Laurent, Schmidt, Catanzaro, Joiner, & Kelley, 1998) assesses the child’s trait-like tendency to respond to autonomic arousal with fear, including dimensions of fear of physiological arousal and fear of mental catastrophe. Cronbach’s alpha for our sample was .83 for the overall total, with subscale alphas of .83 for Fears of Physiological Arousal and .74 for Mental Catastrophe. The 12-item inventory is endorsed on a 4-point Likert scale from 0 – “Not true” to 3 – “True,” with higher levels being indicative of higher symptomatology.

Analyses were conducted using normed t-score values for the subscales. Only anxiety and depression subscales were utilized. For the PRS-C, internal consistencies were .85 for anxiety and .94 for depression. For the PRS-A, internal consistencies were .85 for anxiety and .91 for depression.
Table 1

Demographic Information

<table>
<thead>
<tr>
<th>Factor</th>
<th>NCCP (n=76)</th>
<th>IHM (n=62)</th>
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<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
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</tr>
<tr>
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<td>Race</td>
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<tr>
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</table>

Note: * \( p<.05 \); ** \( p<.01 \)
CHAPTER 3
RESULTS

Preliminary Analyses

Chi square analyses were conducted to determine if the two groups of interest, NCCP and IHM, differed on demographic variables. Due to a relatively small number of individuals in each non-Caucasian category, race was dichotomized into Caucasian and Other for comparison analyses. The NCCP group was comprised of significantly more Caucasian participants ($\chi^2 (1) = 4.66, p < .05$) than the IHM group. Some prior research on children with NCCP (Lipsitz et al., 2005) consisted of primarily Caucasian participants, but racial composition was not reported in other research involving NCCP and IHM populations (Lipsitz et al., 2004). No significant differences on any other demographic factors (e.g., age, sex, parent marital status, family income) were found between the two groups. Due to the significant difference between groups on racial composition, race was entered as a covariate in further analyses using multivariate analysis of covariance (MANCOVA) to examine differences between children with NCCP and IHM. Analyses were conducted utilizing the Statistical Package for Social Sciences, Version 17.0 (SPSS 17.0).

To test assumptions required for MANCOVA, histogram plots, skewness, and kurtosis statistics were examined to evaluate the distribution the variables. All variables of interest were positively skewed. Therefore, log transformations were conducted to normalize these variables. Multivariate effects were evaluated using MANCOVA to examine the overall effect of group membership, with univariate analysis of covariance (ANCOVA) utilized to isolate the sources of
multivariate effects. For subscale analyses, a Bonferroni procedure was used, with the alpha level set at .05 divided by the number of subtest comparisons conducted. Partial eta-squared ($\eta^2_p$) was used as a measure of effect size and was interpreted using Cohen’s (1988) criteria (small effect = 0.01, moderate effect = 0.06, large effect = 0.14).

**Between-Groups Analyses**

Controlling for the effect of race as a covariate in the samples, a statistically significant multivariate effect of group membership was found on the dependent variables using MANCOVA between children with NCCP and IHM: Wilk’s $\lambda = .676, F(12,102)= 4.074$, $p<.000$, $\eta^2_p = .324$. Further analyses were then conducted to isolate individual sources of this difference. Between-groups differences on functional disability, somatization, anxiety sensitivity, anxiety, and depression were analyzed using ANCOVA. Results of the ANCOVAs are presented in Table 2.

**Functional Disability.** Significant differences were found in functional disability using the standardized FDI for both parent ($\eta^2_p = .143$; FDI-P) and child ($\eta^2_p = .188$; FDI-C) report, with children with NCCP experiencing a greater degree of functional disability. Although significant differences in full days of school missed were not found, children with NCCP did miss significantly more partial days of school ($\eta^2_p = .045$). Parents of children with NCCP also reported that their children were significantly less involved in extracurricular activities than parents of children with IHM ($\eta^2_p = .018$).

**Internalizing Symptoms.** Both parent ($\eta^2_p = .204$; CSI-P) and child report ($\eta^2_p = .190$; CSI-C) indicated greater somatic symptoms for children with NCCP than for those with IHM. Children with NCCP also reported experiencing greater anxiety sensitivity ($\eta^2_p = .120$; ASIC). At the subscale level, children with NCCP reported greater Fear of Physiological Arousal
\(F(3,123) = 10.127, p < .000, \eta^2_p = .139; \text{NCCP: } M = 5.13, SD = 4.44, \text{IHM: } M = 2.30, SD = 3.30\), but similar levels of Mental Catastrophe \(F(3,123) = 1.851, p = .161, \eta^2_p = .029; \text{NCCP: } M = 1.06, SD = 2.14, \text{IHM: } M = 0.57, SD = 1.36\) as children with IHM. Children with NCCP reported greater symptoms of anxiety for themselves than children with IHM \(\eta^2_p = .048; \text{MASC}\), with 3 percent of children with NCCP falling in the clinical severity range (t-score \(\leq 65\)), compared with no children in the IHM group. For the MASC, subscale analyses were conducted showing children with NCCP reported greater Physical Symptoms \(F(1,124) = 59.724, p < .000, \eta^2_p = .325; \text{NCCP: } M = 49.27, SD = 8.67, \text{IHM: } M = 39.29, SD = 5.81\), including Tense/Restless symptoms \(F(1,124) = 17.275, p < .000, \eta^2_p = .122; \text{NCCP: } M = 45.44, SD = 8.80, \text{IHM: } M = 39.74, SD = 6.15\) and Somatic/Autonomic symptoms \(F(1,124) = 84.104, p < .000, \eta^2_p = .404; \text{NCCP: } M = 52.92, SD = 9.12, \text{IHM: } M = 40.81, SD = 5.92\) than children with IHM. Parent report of child anxiety symptoms showed no differences between groups, with 4.7 percent of children with NCCP falling in the clinically significant range, compared to 8.6 percent of children with IHM.

Children with NCCP reported greater symptoms of depression \(\eta^2_p = .089\), with 10.4 percent of children with NCCP falling in the clinical severity range, compared with no children in the IHM group. Children reported greater depressive symptoms on the subscales of the CDI including Anhedonia \(F(1,125) = 7.869, p = .006, \eta^2_p = .059; \text{NCCP: } M = 47.55, SD = 9.61, \text{IHM: } M = 42.23, SD = 7.88\) and Negative Self-Esteem \(F(1,124) = 11.526, p < .001, \eta^2_p = .325; \text{NCCP: } M = 47.25, SD = 8.81, \text{IHM: } M = 42.74, SD = 5.61\) than children with IHM. Parents reported similar levels of depressive symptoms for both groups of children, with 12.5 percent of children in the NCCP group falling in the clinically significant range compared with 8.6 percent of children in the IHM group.
### Table 2

**Between Groups ANCOVA**

<table>
<thead>
<tr>
<th>Factor</th>
<th>NCCP</th>
<th>IHM</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>M (SD)</em></td>
<td><em>M (SD)</em></td>
<td><em>F</em></td>
<td><em>p</em></td>
<td><em>η²</em></td>
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<tr>
<td><strong>Functional Disability</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parent Report (FDI-P)</td>
<td>4.15 (5.92)</td>
<td>1.16 (3.16)</td>
<td>18.93**</td>
<td>.000</td>
<td>.143</td>
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<tr>
<td>Range:</td>
<td>0-34</td>
<td>0-18</td>
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<td></td>
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</tr>
<tr>
<td>Child Report (FDI-C)</td>
<td>6.84 (7.19)</td>
<td>2.03 (2.46)</td>
<td>26.18**</td>
<td>.000</td>
<td>.188</td>
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<tr>
<td>Range:</td>
<td>0-47</td>
<td>0-10</td>
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<tr>
<td>Full Days of School Missed</td>
<td>3.23 (4.36)</td>
<td>2.59 (3.40)</td>
<td>0.18</td>
<td>.671</td>
<td>.002</td>
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<tr>
<td>Range:</td>
<td>0-24</td>
<td>0-22</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Partial Days of School Missed</td>
<td>1.17 (2.30)</td>
<td>0.44 (1.00)</td>
<td>4.10*</td>
<td>.045</td>
<td>.035</td>
</tr>
<tr>
<td>Range:</td>
<td>0-11</td>
<td>0-4</td>
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<tr>
<td>Extracurricular Activity Level</td>
<td>1.35 (0.75)</td>
<td>1.63 (0.55)</td>
<td>5.80*</td>
<td>.018</td>
<td>.049</td>
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<tr>
<td>Range:</td>
<td>0-2</td>
<td>0-2</td>
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<tr>
<td><strong>Somatization</strong></td>
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<tr>
<td>Parent Report (CSI-P)</td>
<td>12.36 (11.18)</td>
<td>5.63 (7.80)</td>
<td>28.93**</td>
<td>.000</td>
<td>.204</td>
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<td>Range:</td>
<td>2-67</td>
<td>0-34</td>
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<tr>
<td>Child Report (CSI-C)</td>
<td>17.64 (13.00)</td>
<td>7.89 (9.00)</td>
<td>26.47**</td>
<td>.000</td>
<td>.190</td>
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<td>Range:</td>
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<td><strong>Anxiety</strong></td>
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<tr>
<td>Parent Report (BASC-2)</td>
<td>48.63 (10.99)</td>
<td>48.38 (10.92)</td>
<td>0.004</td>
<td>.950</td>
<td>.000</td>
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<tr>
<td>Range:</td>
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<td>31-81</td>
<td></td>
<td></td>
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<td>Child Report (MASC)</td>
<td>45.76 (9.43)</td>
<td>41.50 (8.73)</td>
<td>5.73*</td>
<td>.018</td>
<td>.048</td>
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<td>Range:</td>
<td>26-68</td>
<td>25-61</td>
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<td>Anxiety Sensitivity (ASIC)</td>
<td>6.21 (5.32)</td>
<td>2.87 (4.08)</td>
<td>15.41**</td>
<td>.000</td>
<td>.120</td>
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<tr>
<td><strong>Depression</strong></td>
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<tr>
<td>Parent Report (BASC-2)</td>
<td>51.97 (14.52)</td>
<td>48.02 (12.18)</td>
<td>2.15</td>
<td>.145</td>
<td>.019</td>
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<tr>
<td>Range:</td>
<td>36-117</td>
<td>37-92</td>
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<tr>
<td>Child Report (CDI)</td>
<td>47.06 (9.91)</td>
<td>41.11 (5.54)</td>
<td>11.02**</td>
<td>.001</td>
<td>.089</td>
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<tr>
<td>Range:</td>
<td>34-79</td>
<td>34-59</td>
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</table>

*Note:* *p*<.05; **p**<.01; *a*Partial eta-squared (*η²*), a measure of effect size, interpreted as 0.01, small effect; 0.06, medium effect; 0.14, large effect.
CHAPTER 4

DISCUSSION

As was hypothesized, children with NCCP experienced greater levels of functional disability and psychosocial distress than children with IHM. Specifically, children and parents of children with NCCP reported greater functional disability, including more partial days of school missed and less involvement in extracurricular activities, than children with IHM and their parents. Children with NCCP reported greater levels of anxiety, anxiety sensitivity, and depression than children with IHM. Parent report of child anxiety and depression was not significantly different between the two groups.

In the first known investigation to assess functional disability in children and adolescents with NCCP, our sample of children and their parents reported greater amounts of functional disability, reporting several times more impairment completing every day activities when compared to children with IHM. These results from data obtained using paper and pencil measures are supported by findings regarding school attendance, a developmentally appropriate measure of functional disability for children and adolescents. Although children with IHM and NCCP missed similar numbers of full days of school, missing partial days of school may still be indicative of impairment. Knowing that these children miss greater amounts of school, it is important to consider the long term implications of school absenteeism, as longitudinal studies have shown that absenteeism is a risk factor for school drop-out, as well as economic, marital, social and psychological problems in adulthood (Kearney, 2008). Although the causes for school absenteeism are unknown in this sample, literature on other idiopathic pain populations
suggests that parental activity restriction (e.g. allowing children to stay home from school due to pain) has been shown to be predictive of symptom maintenance in some children (Walker, Claar, & Garber, 2002). Further studies of functional disability in children with NCCP should investigate the reasons for school absences. Parents also reported that their children with NCCP were less involved in extracurricular activities, a domain that is particularly important at this stage in social development.

In support of the conceptualization that NCCP may be one symptom in a larger constellation of somatic symptom experiences, our sample of children with NCCP experience more than twice the level of additional somatic symptoms when compared to children with IHM. Somatic symptoms and fears of physiological arousal have been shown to account for a large percentage of the variance in chest pain severity for children with NCCP (Gilleland, et al., 2009). Children with NCCP may also develop a tendency towards somatization through observation and modeling from their parents (Craig, Cox & Klein, 2002). Parents may also inadvertently reinforce pain and illness behaviors, as parental worries about their child’s emotional health have been shown to be related to higher pain promoting behaviors, such as allowing the child to stay home from school or giving the child extra attention (Guite, Logan, McCue, Sherry, & Rose, 2009). Santalahi and colleagues (2005) have also demonstrated that these children are likely to continue to experience somatic symptoms in the future. Considering that these children also experience greater levels of anxiety sensitivity, particularly fears of physiological arousal, experiences of somatic symptoms are likely linked to increased interoceptive awareness and catastrophic interpretations of these interoceptive experiences.

Children with NCCP reported higher anxiety than children with IHM, similar to other research in NCCP (Lipsitz et al., 2004; Lipsitz et al., 2005). With regards to dimensions of
anxiety, children with NCCP reported greater somatic symptoms of anxiety and feelings of tension and restlessness, which is consistent with the overall conceptualization that these children experience psychological distress as physiological symptoms. Parental report of child anxiety was similar for both groups. Children with NCCP also reported greater symptoms of anxiety sensitivity than children with IHM, consistent with prior research in NCCP (Lipsitz et al., 2004). Anxiety sensitivity is considered a partly heritable personality trait and there is a growing body of literature supporting anxiety sensitivity as a risk factor for increased pain and disability (Gatchel et al., 2007). In terms of dimensions of anxiety sensitivity, our sample of children with NCCP also reported greater fears of physiological arousal, consistent with findings by Lipsitz and colleagues (2004), but they did not report greater fears of mental catastrophe. Greater levels of anxiety and anxiety sensitivity, particularly fear of physiological arousal, may also be related to increased functional disability due to fear of pain, resulting in avoidance of activities that may result in pain, and perpetuating a cycle of avoidance, inactivity, and disability (Gatchel, et al., 2007; Vlaeyen & Linton, 2000).

In contrast to other research on NCCP (Lipsitz et al., 2004), our sample of children with NCCP reported greater levels of depressive symptoms than children with IHM. Report of depressive symptoms was unique to child report, as parents’ reports of depressive symptoms were similar for both groups. A lack of significant findings per parent report on internalizing symptoms is often found in research involving children and adolescents, due to the internal and less observable nature of these symptoms. It is interesting to note that parents reported higher levels of somatic symptoms for children with NCCP, but did not note higher levels of anxiety or depression. This suggests that parents of children with NCCP are observing these children’s somatic symptoms and seeking treatment for these symptoms, but are not noticing higher levels
of depression or anxiety, despite children endorsing such symptoms for themselves. For children with pain, depressive symptoms have been shown to be a powerful predictor of pain-related disability (Kashikar-Zuck, Goldschneider, Powers, Vaught, & Hershey, 2001). For children with NCCP, this may be particularly relevant, as they also reported greater symptoms of anhedonia and negative self-esteem. Anhedonia represents a low enjoyment of activities and, as previously noted, these children are less involved in extracurricular activities than their peers. Lower participation also reduces opportunities for the establishment of self-efficacy and self-esteem. Internalizing symptoms and functional disability may result from a common process, such as using maladaptive coping strategies (e.g., catastrophizing, avoidance) that have been shown to contribute to increased pain (Kashikar-Zuck, Vaught, Goldschneider, Graham, & Miller, 2002).

In terms of limitations, the study was cross-sectional in design. This precluded investigations as to whether the development of internalizing symptoms and functional disability preceded or followed the development of chest pain for children with NCCP, as could be examined using a longitudinal design. Longitudinal studies of children with NCCP and psychological distress and functional disability are especially critical, due to the possibility of reciprocal relationships and interactions between these variables. Although consistent with prior research on NCCP, our study examined a relatively small number of children with NCCP and IHM, and recruitment was from one part of the country, thus future studies should attempt to recruit larger and geographically diverse samples to replicate these findings. Finally, considering the biopsychosocial nature of pain, the assessment of family variables and parental psychopathology would likely have resulted in a more thorough understanding of factors that may be associated with the development and maintenance of pain for these children.

Taking into consideration that no cardiac etiology was identified for the chest pain, as
well as our results, it is likely that psychosocial factors were contributing to the child’s experience of pain and disability. Guite and colleagues (2009) found that for parents of children with chronic pain who held stronger beliefs that the origin of the pain was exclusively medical also reported higher levels of child functional disability. Not receiving a clear medical explanation for chest pain symptoms may not resolve parents’ or children’s concerns. Educating parents and children about psychosocial factors shown to contribute to pain may be helpful steps towards alleviating pain, as research in other pain populations suggests that visits to the doctor for physical symptoms may be part of an established pattern of inappropriate medical health care seeking associated with emotional and behavioral concerns (Campo et al., 2007). Increased awareness of psychological factors associated with pain may lead parents to seek other forms of care for their children, such as cognitive behavioral therapy for pain. These findings emphasize the need for increased consideration of child psychological functioning in medical health care for children with NCCP.

Although pain is often a warning sign of physical illness and should not be ignored, our findings suggest that factors contributing to pediatric noncardiac chest pain are being incompletely addressed during visits to cardiologists. The focus of the medical referral and cardiologists’ evaluation is primarily on the physical well-being of the child and ruling out cardiac etiologies for NCCP, and the importance of this is not to be understated. For some patients and parents, this assessment may be both reassuring and sufficient. Evaluation of child and family psychological factors may prove to be instructive in identifying contributors to pediatric chest pain for many patients. The addition of psychological screening instruments in medical offices (e.g., Hayutin et al., 2009) could facilitate the referring primary care physicians’ and cardiologists’ ability to identify potential psychosocial contributors to patients’ pain. This
information could be used to route families to psychological resources if needed and reduce future strain and unnecessary costs for the health care system. If left untreated, it is likely that these children with continue to experience high levels of psychological distress and functional disability.
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doi:10.1177/000992289002900702


