THE ROLE OF PSYCHOSOCIAL FACTORS IN PAIN SEVERITY AND SOMATIC FUNCTIONING AMONG CHILDREN WITH RECURRENT CHEST PAIN

by

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(Under the Direction of Ronald Blount)

ABSTRACT

Objective: To explore more comprehensive models of psychosocial factors influencing pain and somatic functioning in children with non-cardiac chest pain (NCCP). *Methods*: During evaluations at cardiology clinics, psychosocial and physical functioning measures were collected from 35 participants with NCCP and their parents. *Results*: Children's somatic functioning and fear of physical arousal predicted significant variance in children's chest pain severity ratings. Additionally, children's depressive symptoms, fear of physiological arousal, and maternal levels somatization were each significant predictors of children's somatic functioning. Functional disability was more closely associated with children's somatic symptoms than children's chest pain severity. *Conclusions*: These results suggest key psychological and familial factors to address in therapeutic programs designed to decrease NCCP, reduce general somatic complaints, improve families' psychosocial functioning, and decrease economic and resource burdens on health care systems.

INDEX WORDS: Chest pain, NCCP, Child Somatization, Psychosocial pain influences

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TABLE OF CONTENTS

Page

ACKNOWLEDGEMENTS iv

LIST OF TABLES vi

CHAPTER

1 INTRODUCTION 1

2 METHOD 6

Settings and Participants 6

Procedures 6

Instruments 7

3 RESULTS 11

Overview 11

Demographic Factors and Between Reporter Differences 11

Children's Chest Pain: Correlational and Regression Analyses 12

Children's Somatic Functioning: Correlational and Regression Analyses 13

Functional Disability Correlational Analyses 15

4 DISCUSSION 16

REFERENCES 22

LIST OF TABLES

Page

Table I: *Psychosocial Correlates of Children's Reported Chest Pain* 27

Table II: *Hierarchical Regression of Children's Reported Chest Pain*.....28

Table III: *Psychosocial Correlates of Child Somatization* 29

Table IV: *Hierarchical Regression of Children's Somatization*.....30

CHAPTER 1

INTRODUCTION

Chest pain is a commonly occurring physical symptom in children and adolescents. Episodes of chest pain are reported by about 10% of school-age children and are the second most common reason for referral to pediatric cardiologists (Garber, Walker, & Zeman, 1991; Roth-Isigkeit, Thyen, Stoven, Schwarzenberger, & Schmucker, 2005; Selbst, Ruddy, Clark, Henretig, & Santilli, 1988). In addition to being a frequent problem, chest pain in children may persist for years. One study found symptoms of chest pain persisting in 86% of the participants 1 to 3.5 years after their initial medical evaluation (Lipsitz et al., 2004). Other investigations found continued chest pain symptoms for at least two years in 49% and 43% of their samples (Lam & Tobias, 2001; Selbst, Ruddy, & Clark, 1990).

Symptoms of chest pain may be cardiac or non-cardiac in origin. The most common cardiac etiologies of chest pain include structural abnormalities, acquired diseases, and dysrhythmias, while non-cardiac etiologies of chest pain can include thoracic and gastrointestinal abnormalities, hyperventilation, and psychological symptoms (Brenner, Ringel, & Berman, 1984). In addition, individuals may experience non-cardiac chest pain which is idiopathic, or of unknown origin. The most common causes of pediatric chest pain are non-cardiac (Lam & Tobias, 2001; Massin et al., 2004; Selbst et al., 1988; Tunaoglu et al., 1995; Yildirim et al., 2004). Pediatric studies have found 89-96% of patients presenting in cardiology clinics and emergency rooms are diagnosed with non-cardiac chest pain (Lam & Tobias, 2001; Massin et al., 2004; Tunaoglu et al., 1995). Selbest et al. (1990) evaluated 407 children who presented in the

emergency room with chest pain, and a cardiac etiology was found in only 4% of their patient sample. Another study investigated the origins of chest pain in a sample of 300 children referred to a pediatric cardiology unit and found 92% of the children had non-cardiac etiologies for their chest pain, and within the non-cardiac group, 63.4% of the children had chest pain which was idiopathic in origin (Yildirim et al., 2004). These data indicate that pediatric chest pain rarely involves cardiac dysfunction and is oftentimes unexplained.

The biopsychosocial model may be used to aid in understanding and conceptualizing the factors that influence the severity of pediatric chest pain. In this model, biological, psychological, and social factors influence one another, in addition to having a collective effect on health outcomes (Engel, 1977). This model has been used as a heuristic for understanding other areas of pediatric pain, including recurrent abdominal pain, chronic pain, and cardiovascular reactivity (Boyce, Barr, & Zeltzer, 1992; Drossman, 1996; Hyams & Hyman, 1998; Zeltzer, Bursch, & Walco, 1997). Although epidemiological data show that pediatric chest pain is a common and persistent problem, research investigating the psychosocial influences on non-cardiac chest pain (NCCP) is scarce. Of the few studies that have been conducted, the available data indicate that psychosocial factors play a prominent role in the development and maintenance of pain symptoms.

In early conceptualizations, Brenner et al. (1984) described some non-cardiac chest pain as “psychogenic” and proposed that this type of pain may be evidence of a somatoform disorder. Somatization is conceptualized as a propensity to experience physical symptoms and communicate somatic distress that are unexplained by medical findings, to attribute these symptoms to physical illness, and to seek medical attention for the symptoms (Lipowski, 1988). If non-cardiac chest pain is indeed psychosomatic in nature, then perhaps somatizing individuals

are more sensitive and attentive to pain signals and therefore are more likely to experience or interpret normal physiological signals as somatic complaints. These physical complaints may often impair a child's ability to perform in everyday roles at home and at school, thus limiting their functional abilities (see L. S. Walker & Greene, 1991).

Additional investigations indicate that children with chest pain frequently report distressing psychological symptoms (Lipsitz et al., 2004; Lipsitz et al., 2005; Tunaoglu et al., 1995; Yildirim et al., 2004). For example, Lipsitz et al. (2004) found that children with NCCP reported more symptoms of anxiety, physical symptoms of anxiety, tension, anxiety somatic symptoms, anxiety sensitivity, and physiological arousal than children with benign murmurs. Among children with NCCP, the results of an unstructured interview indicated that psychiatric symptoms were found in about 75% of the population, with anxiety being the most common symptom (Tunaoglu et al., 1995). One study reported that 56% of their NCCP sample met diagnostic criteria for an anxiety disorder (Lipsitz et al., 2005). Further, 30% of their sample met criteria for two or more anxiety disorders and 33% met criteria for panic disorder (Lipsitz et al., 2005). Another study found that approximately 10% of children in a chest pain sample met diagnostic criteria for depression (Yildirim et al., 2004). In an investigation of adults with NCCP, the results indicated that 24% of the sample experienced either anxiety or depression (Eslick, Jones, & Talley, 2003). Taken together, these data suggest that symptoms of anxiety and depression may play an important role in the etiology or maintenance of non-cardiac chest pain across the lifespan.

In addition to intrinsic child factors, research in the area of recurrent pain suggests that family members may influence somatic development by serving as models and agents for prompting and reinforcing the children's pain and illness behaviors (Craig, Bialas, Hodson, &

Cox, 2004; Craig, Cox, & Klein, 2002a; Schanberg et al., 2001; L. S. Walker, Garber, & Greene, 1994; L. S. Walker & Greene, 1989). Children may develop illness behavior by modeling the behavior of family members who have multiple somatic complaints. Craig, Cox, and Klein (2002) found that children of mothers with chronic somatization are more likely to have health complaints than children of healthy mothers or mothers with a diagnosable medical illness (Craig et al., 2002a). Other studies have found that children of mothers (L. S. Walker & Greene, 1989) and fathers (L. S. Walker et al., 1994) with high levels of somatic complaints experience more physical symptoms. Similarly, Blount et al. (2004) found the severity of syncope displayed in children who tested negative for neurocardiogenic syncope was highly correlated with the somatic complaints of their fathers. In addition, the literature indicates that parents of children with chest pain worry more about their children's physical and psychosocial health than parents of children with diagnosable cardiac dysfunction (R. E. Walker, Gauvreau, & Jenkins, 2004). As a whole, these findings indicate that parental psychological functioning, modeling, and possible reinforcement of symptoms may influence the development and continuation of their children's non-cardiac chest pain.

The purpose of the present study is to explore more comprehensive models of psychosocial factors influencing pain and somatic functioning in children with non-cardiac chest pain. The participants' psychological and physical functioning were explored using measures of depression, anxiety sensitivity, somatization symptoms, and functional disability, as well as maternal somatization symptoms. In terms of physical functioning, the severity of the participant's chest pain was predicted to be positively correlated with the parent and child reports of children's somatic symptoms. For children's psychological symptoms, the severity of the children's chest pain was hypothesized to be positively correlated with reports of child anxiety

sensitivity and depression, and inversely correlated with adaptability. At the family level, the severity of the participant's chest pain was hypothesized to be positively correlated with the mothers' reports of their own somatization symptoms. Similarly, children's general somatic symptoms are expected to be positively correlated with their fear of physical arousal, depression, and maternal somatization symptoms, and inversely correlated with their adaptability. With these hypothesized psychosocial relationships as a guide, regression models predicting children's chest pain and somatic functioning will be built incorporating significant psychological and familial predictors. Finally, both chest pain severity and children's general somatic symptoms are expected to be positively associated with children's functional disability.

CHAPTER 2

METHOD

Settings and Participants

The present investigation is a multi-site study involving three pediatric cardiology clinics in Atlanta, Snellville, and Athens, Georgia. The participants in this study consisted of 35 pediatric patients between the ages of 8 and 18 presenting with chest pain. Participants were excluded from the study if parent or child was non-English speaking (N=1) or if the child had a medical condition which could account for their physical symptoms and functional disability (e.g., cerebral palsy; N=1). The mean child age was 12.5 years (*SD*=2.59 years) and 54 percent were female. The ethnic makeup of the sample was 71.4% Caucasian, 20.0% African-American, and 8.6% Hispanic. Thirty-three mothers (94.3%) and two fathers completed demographic, parent report, and self report measures.

Procedures

During their initial visit to the cardiologist to be evaluated for complaints of chest pain, participants were recruited and informed consent was obtained by research team members or medical office staff. As part of the medical visit, data were collected in the cardiac clinics prior to the participants meeting with the cardiologist (i.e., to receive feedback that their pain was non-cardiac in origin). Participants and their parents completed separate self-report measures assessing emotional, social, and physical functioning. The participants were asked to complete a measure of chest pain severity. Additionally, parents completed questionnaires on demographics. As a component of the proposed study, the participants' medical records were reviewed to obtain

information regarding the child's diagnosis and medical history. No financial compensation was provided for participation in this study. Referrals for psychological services were given to families as necessary. This study was approved by the University of Georgia and Emory School of Medicine's Institutional Review Boards.

Instruments

All instruments included in the current investigation were questionnaires. Children and adolescents completed self-report measures of: chest pain severity (CPQ), somatic symptoms (CSI- child), functional disability (FDI- child), anxiety sensitivity (ASIC), and depressive symptoms (CDI). Parents completed measures of: demographic information, their child's somatic symptoms (CSI- parent), their child's functional disability (FDI- parent), their child's adaptive behaviors (BASC-PRS), and their own somatic symptoms (SCL-90-R Somatization dimension). Children younger than 11 or with reading difficulties were assisted in completing the questionnaires by the experimenters. Older children were given reading assistance when necessary. The time to complete all the inventories was approximately 40 minutes.

Demographic Questionnaire. The demographic questionnaire assesses general demographic information including the child's age and race; parent's marital status, occupation, and education; family income; and the child's academic attendance and involvement. This questionnaire is completed by the participant's parent.

Chest Pain Questionnaire (CPQ). The CPQ was created for use in this study to assess for the child's chest pain intensity on 10 point visual analog scales with verbal anchors of "1- no pain" and "10- extreme, worst pain imaginable." The items from the questionnaire include: "Usually, how severe is the pain when you experience chest pain?" and "What is the worst level of pain you have experienced during a chest pain episode?" Based on a systematic review, visual

analog scales have been classified as well-established, evidence-based assessment tools for gauging children's pain severity (Cohen et al., in press).

Child Somatization Inventory (CSI- child; CSI- parent). The CSI assesses the type and intensity of 35 child somatic complaints (Garber et al., 1991). Each item is scored on a five point Likert scale rating intensity from 0- "not at all" to 4- "a whole lot". The CSI has a test-retest reliability ranging from r=.50 (parent report) to r=.60 (child report) over an interval of 6 weeks, an internal consistency of .92 in a community sample, and acceptable construct validity (Garber et al., 1991; L. S. Walker & Garber, 2003). The CSI contains items such as, "In the last 2 weeks, how much were you bothered by pains in your stomach or abdomen?" and "In the last 2 weeks, how much were you bothered by headaches?" (Garber et al., 1991). For analyses investigating relationships between child somatization and other psychosocial variables, the total CSI scores were used. Within the current sample, the total CSI had an internal consistency of .80 (CSI-parent, total) and .90 (CSI- child, total). For analyses investigating the associations between child somatization and chest pain, the CSI item assessing chest pain symptoms was removed. The modified CSI had coefficient alphas of .79 (CSI- parent, modified) and .90 (CSI- child, modified).

Anxiety Sensitivity Inventory for Children (ASIC). The ASIC is a modification of an adult measure, the Anxiety Sensitivity Inventory (ASI), which essentially measures "fear of fear." The ASIC is factor analytically derived and is consistent with theories of anxiety sensitivity in the adult literature (Laurent, Schmidt, Catanzaro, Joiner, & Kelley, 1998). This child-completed measure contains 12 items with responses scored on a four point scale (0=not true, 1=sometimes true, 2=mostly true, 3=true). The ASIC evaluates statements such as, "It scares me when my heart beats rapidly", "It scares me when I'm nervous", and "When my body

feels strange it scares me" (Laurent et al., 1998). The ASIC yields scores for total anxiety sensitivity and two dimensions of anxiety sensitivity, fear of physiological arousal and fear of mental catastrophe. For the purposes of this investigation, only the fear of physical arousal subscale was utilized. In the present sample, the ASIC fear of physical arousal subscale had a coefficient alpha of .83.

Child Depression Inventory (CDI). The CDI is a child-completed measure assessing specific symptoms of depression (Kovacs, 1992). Responses to the 27 items are scored on a three point scale (0=absence of symptoms, 1=mild symptoms, 2=definite symptoms). The CDI has well established concurrent and discriminant validity (Kovacs, 1992). For the current study items indicative of physical symptoms of depression were removed. These four items included worry about aches and pains, fatigue, sleep problems, and poor appetite. The rationale for removing these items was to isolate cognitive and emotional symptoms of depression from those symptoms which might be more indicative of pain and somatic functioning. Within the current sample, the CDI total score had a coefficient alpha of .88; when the physical symptoms were removed for the purposes of analyses, the modified scale (CDI non-physical) had a coefficient alpha of .87.

Behavior Assessment System for Children-2 – Parent Rating Scales (BASC-2-PRS). The BASC-2-PRS assesses child and adolescent behaviors and reports on psychological functioning (Reynolds & Kamphaus, 2004). Two versions were used in this study, a form for children 6 to 11 years and adolescents 12 to 18 years. The BASC-2-PRS contains 150 items and the child's behaviors are rated on 4-point scale (0=never, 1=sometimes, 2=often, 3=always). The BASC 2-PRS subscale included in this study was the Adaptability factor, which has coefficient alphas ranging from .81 to .86 based on age and gender (Reynolds & Kamphaus, 2004). The

BASC has well established reliability and validity (Reynolds & Kamphaus, 2004).

Symptom Checklist-90-R (SCL-90-R). The SCL-90-R assesses psychological symptoms in adults (L.R. Derogatis, 1977). For this investigation, only the somatization dimension was used, primarily to assess corresponding patterns of somatic functioning between mothers and their children. The SCL-90-R Somatization dimension has an internal consistency ranging from .86 to .88, as well as established convergent validity with other adult measures of psychopathology (L.R. Derogatis, Rickles, & Rock, 1976). Mothers rated 12 physical symptoms on a five point scale (0=not at all, 1=a little bit, 2=moderately, 3=quite a bit, 4=extremely). The internal consistency was .84 for this sample of mothers.

Functional Disability Inventory (FDI- child; FDI- parent). The child and parent versions of the FDI assess the impact of physical health status on children's difficulty in age-appropriate physical and psychosocial functioning in everyday social roles (L. S. Walker & Greene, 1991). The FDI contains 15 items, and responses are scored on a five point scale (0=no trouble, 1=a little trouble, 2=some trouble, 3=a lot of trouble, 4=impossible). Sample items from the FDI include: "In the past two weeks have you had any physical trouble or difficulty… walking up stairs?", "…being at school all day?", and "…getting to sleep at night and staying asleep?" (L. S. Walker & Greene, 1991). The FDI has published coefficient alphas of .88 for the child version and .92 for the parent version (L. S. Walker & Greene, 1991). Within the present sample, the coefficient alphas are .84 for the child version and .82 for the parent version.

CHAPTER 3

RESULTS

Overview

Preliminary correlational and between group analyses assessed the association between demographic factors and measures of chest pain and child somatization. Paired samples t-tests were then conducted to examine differences in child and parent reports of child somatization and functional disability. Pearson correlational analyses were conducted to determine the association between psychosocial variables and children's chest pain severity, as well as child and parent report of child somatic functioning. Significant psychosocial correlates were considered for entry into hierarchical linear regression models predicting child chest pain severity, as well as child and parent report of children's somatic functioning. Finally, the relationships between chest pain, child somatization, and functional disability were explored using correlational analyses and compared using t-tests for related correlations.

Demographic Factors and Between-Reporter Differences

Correlational and ANOVA analyses revealed no significant differences in age, gender, or ethnicity on the variables of interest in this study. Paired samples t-tests were conducted to evaluate differences in parent and child reporting on child somatization (CSI- child and CSI-parent) and functional disability (FDI-child and FDI-parent). There was a statistically significant difference in the child (M= 20.9, SD= 14.96) and parent (M= 13.9, SD= 10.62) standard version of the CSI (t(34)= 4.38, p=.000, CI: 3.75, 10.25; d=.54). There also was a statistically significant difference in the child (M= 18.4, SD= 14.31) and parent (M= 11.9, SD= 10.17) modified CSI

scores with the chest pain item removed ($t(34)= 4.20$, $p=.000$, CI: 3.38, 9.71; $d=.53$). Additionally, there was a statistically significant difference in the child ($M= 9.0$, $SD= 8.71$) and parent ($M= 5.6$, $SD= 5.75$) FDI scores ($t(34)= 2.53$, $p=.016$, CI: .671, 6.13; $d=.46$). As the parent and child reports of child somatization and functional disability were significantly different, parent and child reports were considered separately rather than forming composite scores.

Children's Chest Pain: Correlational and Regression Analyses

The relationships between children's pain severity, somatization, and psychosocial variables were investigated using Pearson product-moment correlation coefficients. Table I displays the bivariate relationships between pain severity and psychosocial predictor variables. There were significant positive relationships between children's usual chest pain experience and child report of somatization with the chest pain item removed (CSI-child, modified), parent report of child somatization with the chest pain item removed (CSI-parent, modified), children's fear of physical arousal (ASIC), and children's report of depression with physical symptoms of depression removed (CDI non-physical). There was a significant negative relationship between usual chest pain experience and parent report of child adaptability (BASC). Additionally, there were similar patterns of significant positive relationships between children's worst chest pain experience and child report of child somatization with the chest pain item removed (CSI-child, modified), parent report of child somatization with the chest pain item removed (CSI-parent, modified), children's fear of physical arousal (ASIC), and children's report of depression with physical symptoms of depression removed (CDI non-physical). There was also a significant negative relationship between usual level of pain and parent report of child adaptability.

Separate hierarchical regression analyses were used to predict children's usual and worst levels of chest pain. Only variables with significant bivariate relationships to chest pain

severity were considered as potential predictors in the regression models. Parent report of child somatization (CSI-parent, modified) was entered as Block 1 into the pain severity regression models. This was based on the rationale that chest pain can be conceptualized as relating to a larger constellation of pain and somatic symptoms. In order to eliminate rater variance from this aspect of the regression, the modified parent report of child somatization (CSI-parent, modified) was used over the modified child report (CSI-child, modified). Fear of physical arousal, non-physical symptoms of depression, and adaptability were considered for entry on the second block. Non-significant predictors were eliminated. In the trimmed model, ASIC fear of physical arousal was retained in the regression model as Block 2. Table II displays that child somatization alone accounted for 17.3% and 13.8% of the variance in usual and worst chest pain severity, respectively, while children's somatization and fear of physical arousal together accounted for 31.5% and 35.2% of the variance, respectively.

Children's Somatic Functioning: Correlational and Regression Analyses

Given the association between children's chest pain and their other somatic symptoms, we were interested in creating models to evaluate predictors of children's general somatic functioning. To generate potential predictors, the relationships between general child somatization (CSI, total) and psychosocial variables were investigated using Pearson product-moment correlation coefficients. Table III displays the bivariate relationships between child and parent reports of child somatization and psychosocial predictor variables. There were significant positive relationships between child report of somatization (CSI-child, total), children's fear of physical arousal (ASIC), and children's report of depression with physical symptoms of depression removed (CDI non-physical), and maternal report of their own somatic symptoms (SCL-90-R). There were similar patterns of significant positive relationships between parent

report of child somatization (CSI-parent, total), children's report of depression with physical symptoms of depression removed (CDI non-physical), and maternal report of their own somatic symptoms (SCL-90-R). There was also a significant negative relationship between parent report of child somatization and adaptability.

Two additional hierarchical regression models were created to evaluate predictors of child and parent report of child somatization. Variables with significant bivariate relationships with child report of somatization were considered as predictors in the child model, while variables with significant bivariate relationships with parent report of child somatization were considered as predictors in the parent model. In these models, child factors were entered on the first step as more proximal (i.e., intrinsic) predictors of somatic functioning, followed by entry of maternal somatization as a more distal, familial factor (i.e., extrinsic) on the second step. In the child report model, non-physical symptoms of depression and fear of physical arousal were entered as Block I, and maternal somatization was entered as Block II. Table IV displays that child psychological factors accounted for 49.1% of the variance in somatization, with maternal somatization adding a significant 9.6% increment. Child psychological factors and maternal somatization together accounted for 58.7% of the variance in child somatization. In the trimmed parent report model, non-physical symptoms of depression was retained as Block I, and maternal somatization was entered as Block II. Table IV displays that child non-physical depressive symptoms accounted for 49.9% of the variance in somatization, with maternal somatization adding a significant 8.4% increment. Child non-somatic depressive symptoms and maternal somatization together accounted for 58.4% of the variance in child somatization.

Functional Disability Correlational Analyses

The relationships between children's pain severity, somatization, and functional disability were investigated using Pearson product-moment correlation coefficients. Parent report of children's functional disability (FDI-parent) was significantly related to both parent report (CSI-parent, total: r=.70, p=.000) and child report (CSI-child, total: r=.46, p=.006) of child somatization, but did not have significant relationships with children's reported pain severity. Child report of functional disability (FDI-child) was significantly related to both parent report (CSI-parent, total: r=.76, p=.000) and child report (CSI-child, total: r=.74, p=.006) of child somatization, and showed a significant relationship with usual pain severity (r=.42, p=.012) and a trending relationship with worst pain severity (r=.31, p=.066). T-tests for related correlations were conducted to determine whether child somatization had a stronger relationship with functional disability than pain severity. The data indicated that child reported somatization (CSI-child, modified) had a stronger relationship with functional disability than did both usual (t(32)= 2.58, p=.015) and worst (t(32)= 2.39, p=.012) reported levels of chest pain. Similar strength of relationship patterns were found for parent reported child somatization (CSI-parent, modified) and functional disability over usual (t(32)= 3.45, p=.002) and worst (t(32)= 4.05, p=.000) reported levels of pain.

CHAPTER 4

DISSCUSSION

This investigation identified several psychosocial correlates and predictors of children's chest pain and somatization. Children's chest pain severity was strongly associated with physical indices including child somatization and functional disability, psychological domains of depression, anxiety sensitivity and adaptability, and the parental factor of maternal somatization. Similar patterns of biopsychosocial relationships were observed for the prediction of parent and child report of somatization. These relationships suggest important links between pain, other health complaints, and children's psychological and parental functioning.

The data from this investigation suggest that children's non-cardiac chest pain may be a symptom indicative of a larger constellation of unexplained somatic health complaints. The presence of general child somatic complaints predicted significant portions of the variance in both the usual and worst pain severity ratings. These models revealed that higher levels of somatic complaints, combined with anxieties arising from physical arousal, accounted for significant amounts of the variance among children's chest pain experiences. Although the chest pain regression models were empirically constructed, the pairing of fear of autonomic arousal in the presence of somatic symptom experience also appeared to be an apt theoretical combination of factors. Previous literature in the area of pediatric chest pain has indicated that children with chest pain experience higher levels of autonomic arousal than controls (Lipsitz et al., 2004). In another non-cardiac chest pain sample, approximately one third of the participants met criteria for panic disorder (Lipsitz et al., 2005). The data from the present investigation combined with

previous results from the literature underscore the importance of evaluating somatic experience and fear of physical arousal in the pediatric patients with non-chest pain, in addition to more general child psychological constructs such as anxiety and depression.

In this sample of children with chest pain, there were significant discrepancies between parent and child report of child somatization. These discrepancies in parent and child symptom reporting are consistent with data previously presented in the child somatization literature (Garber et al., 1991; Rocha & Prkachin, 2006). Previous literature has also indicated relationships between child somatization and symptoms of depression and anxiety (Egger, Costello, Erkanli, & Angold, 1999; Santalahti, Aromaa, Sourander, Helenius, & Piha, 2005; Zwaigenbaum, Szatmari, Boyle, & Offord, 1999). The present data indicated significant bivariate relationships between child somatic symptoms and psychological variables, including fear of physical arousal, emotional and cognitive symptoms of depression, and child adaptability. Also, consistent with other literature in the area of child somatic functioning, results from this study indicated that maternal somatization evidenced strong associations with both parent and child report of children's somatic functioning (Craig et al., 2004; Craig, Cox, & Klein, 2002b; L. S. Walker et al., 1994; L. S. Walker & Greene, 1989). The observed linear relationship between maternal and child somatic symptoms may be indicative of parental modeling, attending to and prompting, and/or reinforcement of somatic symptoms that may be present in their child.

From the psychosocial correlates of child somatization, three significant factors emerged for the prediction of child somatic functioning (fear of physical arousal, non-physical symptoms of depression, and maternal somatization) and two significant predictors emerged for parental report of child somatic functioning (non-physical symptoms of depression and maternal somatization). Children's fear of physical arousal was a non-significant predictor in the model

for parent report of child somatization. This could be because parents are unaware of the of their children's aversion to physical arousal. These two models indicate that higher levels of depressive symptoms combined with aversion to physiological arousal or high levels of maternal somatization accounted for a significantly large proportions of the variance in children's somatic functioning.

Children's report of functional disability was considered to be one possible undesirable outcome related to both children's chest pain severity and general somatic complaints. Results indicated that functional disability was significantly related to children's usual pain experience and related at the trend level to their worst pain experience; however no significant associations were found between parent's report of children's functional disability and reported pain severity. These differences are likely due to significant discrepancies between parent and child reporting of functional disability, with children reporting significantly higher rates of disability. Previous research has also indicated patterns of parent and child reporting discrepancies on the FDI (Garber, Van Slyke, & Walker, 1998). In addition, children may be more aware of their own functional disability and pain experience. In general, both pain and disability are conceptualized as subjective experiences. In contrast to the findings for chest pain, both child and parent report of children's functional disability were strongly related to both parent and child report of somatization. The t-tests evaluating the strength of these related correlations revealed that the relationship between child somatization and functional disability was significantly stronger than the relationship between children's chest pain and functional disability. In total, these findings imply that children's functional disability may be more related to a larger pattern of health complaints, in which chest pain appears, as opposed to the symptoms of chest pain itself.

An additional noteworthy set of findings in this investigation were the negative relationships between adaptability, chest pain, and child somatic functioning. This suggests that children who have difficulties with social transitions or emotional self-control may be more at risk for experiencing higher levels of pain or somatic symptoms (Reynolds & Kamphaus, 2004). These findings are encouraging because adaptive behaviors are potentially modifiable using behavioral skills-based interventions. Such interventions may result in decreased chest pain and somatic symptoms, as well as serve as an intervention for or protective factor against the common co-morbid depression and anxiety sensitivity associated with chest pain and somatic complaints.

The current study addresses gaps in the pediatric chest pain literature in several ways. Previous research has documented influences of child psychological functioning (Campo et al., 2004; Lipsitz et al., 2004; Lipsitz et al., 2005), parental somatization (L. S. Walker et al., 1994; L. S. Walker & Greene, 1989), and parental distress (Logan & Scharff, 2005; Schanberg et al., 2001) on children's recurrent pain symptoms. However, the associations between chest pain and children's own somatization symptoms and functional disability, as well as their mothers' somatic complains, had not been examined in prior research. In addition, the majority of previous studies of pediatric chest pain have been retrospective in nature, often one to three years following the diagnostic evaluation. In contrast, the present study evaluates children and parents during their initial evaluation for chest pain. Data collection in closer proximity to the onset of chest pain symptoms may facilitate a more accurate representation of the psychosocial factors influencing pain severity and symptom presentation.

There are several limitations to the current investigation which are important to address here and in future studies. Despite efforts to collect somatization data from both mothers and

fathers, SCL-90-R somatization data were available from only a few fathers. Given the relationship between paternal somatization and children's recurrent and unexplained somatic symptoms indicated in the literature (Blount et al., 2004; L. S. Walker et al., 1994), future studies should make intensive efforts to include measures assessing both mothers and fathers somatic and psychological functioning. Also, the literature has shown that pediatric chest pain frequently persists after initial evaluation (Lam & Tobias, 2001; Lipsitz et al., 2004; Selbst et al., 1990). Future investigations of children's NCCP should include follow-up evaluations of their pain, somatic symptoms, and other psychosocial influences.

Additional future research should also employ a multi-site recruitment and collection in order to yield a larger sample size. The resulting increased statistical power would allow the inclusion of more predictors in the regression models, such as the use of adaptive or maladaptive pain coping strategies. Future studies may also begin to explore potential emotional and familial mechanisms for chest pain and other somatic symptom development. Future investigations should explore ways in which parental socialization and somatic functioning influence child health outcomes (i.e., modeling of symptoms, reinforcement of physical symptoms, parental responses to emotional expression, etc.). Investigations could also expand upon evaluating children's psychological functioning and identify common emotion regulation predictors (i.e., awareness, inhibition, lability, etc.) to chest severity and somatic functioning.

Altogether these data indicate important risk factors and possible points for intervention among pediatric chest pain and child somatic populations. Screening for child and familial psychological and somatic functioning in the medical clinics may allow families to find appropriate mental health services to decrease their non-organic pain. Psychosocial interventions targeting symptoms of childhood depression combined with exposure and response prevention

for fears associated with physiological arousal may likely be efficacious in decreasing children's somatic symptoms and subsequent functional disability. In addition to providing relief from physiological and affective symptoms, mental health treatments designed to decrease children's chest pain and other unexplained health complaints could also help to combat rising health care costs and scarcity of medical resources.

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Table I. *Psychosocial Correlates of Children's Reported Chest Pain*

Variable	1	2	3	4	5	6	7	8
1. Usual level of pain (*M*= 6.2, *SD*= 2.14)	--	.81**	.41*	.42*	.46**	.45**	-.35*	.25
2. Worst level of pain (*M*= 7.8, *SD*= 1.93)		--	.45**	.37*	.53**	.32	-.38*	.41*
3. Child somatization- (CSI- child, modified) (*M*= 18.4, *SD*= 14.31			--	.77**	.42*	.59**	-.19	.59**
4. Child somatization- (CSI- parent, modified) (*M*= 11.9, *SD*= 10.17)				--	.23	.68**	-.39*	.63**
5. Fear of Physical Arousal (ASIC) (*M*= 6.6, *SD*= 6.03)					--	.11	-.08	.10
6. Depression (CDI, non-physical) (*M*= 7.9, *SD*= 6.14)						--	-.32	.54**
7. Adaptability (BASC) (*M*= 15.1, *SD*= 4.95)							--	-.46**
8. Maternal somatization (SCL-90-R) (*M*= 8.3, *SD*= 7.41)								--
Note. * $p \leq .05$, ** $p \leq .01$								

Table II. *Hierarchical Regression of Children's Reported Chest Pain*

	B[a]	SEB[b]	β[c]	R^2	Δ R^2	*F*
Usual Level of Chest Pain						
Step 1:						
Child Somatization (CSI parent, modified)	.09	.03	.42*	.17	.17*	6.92*
Step 2:						
Child Somatization (CSI parent, modified)	.07	.03	.33*			
Fear of Physical Arousal (ASIC)	.17	.06	.39*	.32	.14*	7.37**
Worst Level of Chest Pain						
Step 1:						
Child Somatization (CSI parent, modified)	.07	.03	.37*	.14	.14*	5.28*
Step 2:						
Child Somatization (CSI parent, modified)	.05	.03	.26†			
Fear of Physical Arousal (ASIC)	.18	.06	.48**	.35	.21**	8.68**

Note. [a]B, unstandardized coefficients; [b]SEB, standard error of unstandardized coefficients; [c]β, standardized coefficients
* $p \leq .05$, ** $p \leq .01$, † $p \leq .10$

Table III. *Psychosocial Correlates of Child Somatization*

Variable	1	2	3	4	5	6
1. Child somatization- (CSI- child, total) (*M*= 20.9, *SD*= 14.96)	--	.78*	.43**	.59**	-.20	.60**
2. Child somatization- (CSI- parent, total) (*M*= 13.9, *SD*= 10.62)		--	.22	.69**	-.39*	.63**
3. Fear of Physical Arousal (ASIC) (*M*= 6.6, *SD*= 6.03)			--	.11	-.08	.10
4. Depression- (CDI non-physical) (*M*= 7.9, *SD*= 6.14)				--	-.32	.54**
5. Adaptability (BASC) (*M*= 15.1, *SD*= 4.95)					--	-.46**
6. Maternal somatization (SCL-90-R) (*M*= 8.3, *SD*= 7.41)						--

Note. * $p \leq .05$, ** $p \leq .01$

Table IV. *Hierarchical Regression of Children's Somatization*

	B[a]	SEB[b]	β[c]	R^2	Δ R^2	F
Child Report						
Step 1: Child Factors						
Depression (CDI non-physical)	1.4	.32	.57**			
Fear of Physical Arousal (ASIC)	1.0	.39	.34*	.49	.49**	14.48**
Step 2: Child and Parent Factors						
Depression (CDI non-physical)	.89	.34	.37*			
Fear of Physical Arousal (ASIC)	.97	.35	.33**			
Maternal Somatization (SCL-90-R)	.75	.29	.37*	.59	.10*	13.73**
Parent Report						
Step 1: Child Factors						
Depression (CDI non-physical)	1.18	.22	.69**	.50	.50**	30.92**
Step 2: Child and Parent Factors						
Depression (CDI non-physical)	.86	.23	.51*			
Maternal Somatization (SCL-90-R)	.53	.20	.37*	.58	.08*	21.02**

Note. [a]B, unstandardized coefficients; [b]SEB, standard error of unstandardized coefficients; [c]β, standardized coefficients
* $p \leq .05$, ** $p \leq .01$