

Health Care Utilization and Psychosocial Factors in Pediatric Noncardiac Chest Pain

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Objective: This study investigated factors related to health care utilization (HCU) among patients presenting to pediatric cardiologists with symptoms of chest pain later diagnosed as noncardiac chest pain (NCCP). **Methods:** Participants included 67 children and adolescents diagnosed with NCCP and their parent. Measures of HCU, pain severity, and child self-report and parent self-report of anxiety and depression were collected at the cardiologist's office. The child's sex was examined as a moderator of HCU. **Results:** Pain severity and maternal and child depression were significant contributors to the variance in child HCU. The relationship between depression and HCU was moderated by the child's sex, with boys higher in levels of maternal or child depression reporting greater HCU. **Conclusions:** Psychological factors are related to HCU for children with NCCP, with depression positively associated with HCU. The child's sex plays an important role in depression and HCU. Family-focused psychological screening of pediatric patients with NCCP may aid in identifying families who may benefit from referrals for psychological assessment and treatment.

Keywords: health care utilization, pain, children, depression, noncardiac chest pain

Chest pain is a common presenting symptom among children seeking health care, with nearly 10% of school-age children reporting chest pain episodes (Geggel, 2004; Veeram Reddy & Singh, 2010). Evaluation of the chest pain by a pediatric cardiologist includes a full physical exam, radiography, electrocardiography, and possibly additional expensive diagnostic tests. Following medical assessment, the pain is diagnosed as either cardiac or noncardiac in origin, with approximately 80% of pediatric patients receiving a diagnosis of noncardiac chest pain (NCCP) (Thull-Freedman, 2010). While treatment for cardiac chest pain includes surgery or other medical interventions to correct cardiac abnormalities, there is no well-established treatment for NCCP (Cava & Sayger, 2004). Without established treatments, NCCP is a recurrent problem for children that may persist for 1 to 3 years following the initial diagnosis (Lam & Tobias, 2001; Lipsitz et al., 2004).

Among children with chronic idiopathic pain and somatic symptoms, higher pain intensity predicts higher health care utilization (HCU) (Perquin et al., 2001; Roth-Isigkeit, Thyen, Stöven, Schwarzenberger, & Schmucker, 2005). Given the relationship between pain severity and HCU, the common prevalence and recurrent nature of NCCP and associated health care costs, better understanding of factors related to these patients' HCU is critical.

The widely accepted biopsychosocial model, through which biological, social, and psychological factors influence the experience of pain (Gatchel, Peng, Peters, Fuchs, & Turk, 2007), is applicable to the study of NCCP and, by extension, to HCU. In terms of biological factors, children reporting NCCP also report higher rates of other physical symptoms that may require medical evaluation (Gilleland et al., 2009). Literature has indicated that physical health status is the strongest determinant of children's visits to the pediatrician, yet health status accounts for only one sixth of the variance in HCU (Janicke & Finney, 2001). Beyond biological influences, we know psychological and social factors contribute to pain severity and pain-related disability (Kaczynski, Claar, & Logan, 2009; Merlijn et al., 2003), but the role of psychosocial influences on HCU is not as well understood. One of the primary goals of this investigation is to examine psychosocial factors as potential predictors of HCU in children with NCCP.

Among children with various chronic illnesses, those with higher psychological distress utilize more health services than their nondistressed counterparts, even when controlling for severity of physical illness (Richardson, Russo, Lozano, McCauley, & Katon, 2008; Vingilis, Wade, & Seeley, 2007). Utilization of medical

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services is adaptive when the level of HCU is proportional to the severity of or risk indicated by the physical complaint; however, patterns of extensive medical service use for pain that is either caused or exacerbated by psychological distress is both maladaptive and ineffective at treating the source of the complaint. Evaluating the relationship between psychological distress and HCU is particularly salient for children with NCCP, because they have been found to have higher levels of anxiety than a comparable sample with benign cardiac conditions years after their diagnostic cardiac work-up (Lipsitz et al., 2004; Lipsitz et al., 2005). Additionally, Yildirim et al. (2004) found 10% of the children ages 3 to 17 in their sample met criteria for a depressive disorder, as compared with prevalence estimates of 1–3% for school-age children and 5–6% percent for adolescents (Beauchaine & Hinshaw, 2008). Despite significant evidence that children with NCCP present frequently to medical settings and that psychosocial distress is elevated for these children, no studies to date have examined whether psychological factors are related to HCU for children with NCCP.

Parents are integrally involved in decisions to initiate medical visits for their children. As a result, parental characteristics are important social factors to examine when investigating HCU for children with NCCP. Mothers of children with idiopathic pain have greater levels of anxiety and depressive disorders, as well as greater HCU for themselves, compared with mothers of children without pain. However, these mothers do not utilize more psychological services despite having significantly more psychological symptoms (Campo et al., 2007). These findings suggest a pattern of parental health care seeking that is incongruent with their medical and psychological status and needs; a pattern that may extend to parental decisions about seeking health care for their children. Even when psychological symptoms do not reach diagnostic thresholds, parental negative mood and psychological distress are associated with increased visits for the child to the primary care physician (PCP) (Riley et al., 1993). Further, greater psychological distress differentiates parents of children with idiopathic pain who pursue a more intense evaluation from a tertiary care specialist from parents who only seek an evaluation at a PCP for their children with idiopathic pain (Czyzewski, Eakin, Lane, Jarrett, & Shulman, 2007). Taken together, these data indicate that family psychosocial functioning plays an important role in HCU.

The role of the child's sex has been inadequately investigated as it relates to HCU. In a consensus report on adults with pain, Greenspan et al. (2007) concluded that examining the influence of an individual's sex is necessary in investigations of pain. In adults, sex differences have been found in numerous pain-related domains (e.g., differential influence of psychological factors, response to medications). Although research investigating the role of sex with pediatric patients is sparse, findings thus far suggest girls report higher pain severity, but do not differ from boys in chronicity. Anxiety and depressive symptoms are associated with pain in both boys and girls, but strength of association may differ (Keogh & Eccleston, 2006; Merlijn et al., 2003). Additionally, a longitudinal analysis showed internalizing symptoms predict future pain in girls with abdominal pain, but not for boys (Kroner-Herwig, Glassman, van Gessel, & Vath, 2011). Further, girls tend to attribute pain to psychosocial variables, while boys tend to attribute pain to physical influences (Roth-Isigkeit et al., 2005). These attributions may influence treatment seeking. Mothers show greater protectiveness

and monitoring to boys' pain than to girls' pain (Langer et al., 2007). Gender socialization could contribute both to children's reporting of pain and parental responses, including decisions to seek health care. If boys are conceptualized as being "tougher" and more resilient against pain, mothers may take sons' pain complaints more seriously than similar complaints from daughters (Myers et al., 2006). Also, the majority of literature on idiopathic pain consists of predominantly female samples (Kaczynski et al., 2009; Lynch, Kashikar-Zuck, Goldschneider, & Jones, 2007; Perquin et al., 2001; Peterson & Palermo, 2004). However, with NCCP, child sex distribution is slightly more male than female (Gilleland et al., 2009; Lipsitz et al., 2004; Lipsitz et al., 2005). Patients with NCCP are not typically included in samples from pain clinics, where most of the research on pediatric pain, including that on sex differences, has taken place (Kroner-Herwig et al., 2011). Thus, the generalizability of this research to patients with NCCP is unknown, necessitating examination of the influence of sex on HCU in children with NCCP.

The current study addresses gaps in the literature by investigating psychosocial factors related to HCU in children with NCCP. At the bivariate level, higher child HCU was expected to be associated with greater pain severity, as well as child and parent anxiety and depression. Additionally, this study examined the contributions of child and parent psychological factors to the prediction of HCU, beyond those of pain severity. We hypothesized that (a) greater pain severity would be predictive of higher child HCU; (b) greater child psychosocial distress would be predictive of higher HCU; and in a separate model, (c) greater maternal psychological distress would be predictive of higher HCU. An additional goal was to explore sex as a moderator of the relationships between child and parent psychological distress with HCU.

Method

Participants

Participants in the final sample included 67 children and adolescents diagnosed with NCCP who were recruited as new patients from three outpatient cardiology clinics affiliated with the same hospital system in the Southeastern United States and referred by a variety of community medical practitioners. Sample size was determined a priori using G*POWER (Faul, Erdfelder, Buchner, & Lang, 2009). The sample size needed to achieve a recommended power of .80 at $\alpha = .05$ for Hierarchical Multiple Regression with a presumed medium effect size ($f^2 = .25$) and four response variables was 53 participants. Children ranged from 8 to 18 years old ($M = 12.61$ years, $SD = 2.63$). Participants were primarily male (58%), which is representative of other samples of patients with NCCP (Lipsitz et al., 2004; Lipsitz et al., 2005). Eleven potential participants (14%) declined participation due to time demands or for unknown reasons. Self-reported ethnicities represented included 68.7% Caucasian, 25.4% African American, and 5.9% Hispanic. Fifty-nine mothers (83%), eight fathers, and two female guardians participated with a mean age of 41.63 years ($SD = 7.65$, range 26–65). If both parents were present at the evaluation, parents completed separate self-report measures of their functioning. Due to limited paternal participation, paternal report was not included in analyses. Exclusion criteria were non-English speaking parents or children ($n = 1$), having a prior

diagnosis of a medical disorder that could account for the child's physical symptoms and HCU ($n = 2$ children with cerebral palsy), or having a diagnosis of a co-occurring heart condition, even if that condition was not related to their pain ($n = 5$ patients with benign heart murmurs). Four children referred for chest pain required further evaluation to rule out cardiac etiologies, and were therefore excluded from analyses. Using the most conservative estimate, only 6% of our sample with NCCP may have had a cardiac etiology for their chest pain. Diagnoses for exclusion were obtained from the medical chart review after individuals participated in the study.

Procedures

Upon entering the cardiologists' office, individuals who were referred for chest pain evaluations were approached for participation. Informed consent for parents/guardians and assent for children was obtained, along with Health Insurance Portability and Accountability Act release prior to participating. Children and their parent or caregiver completed inventories during the evaluation before receiving diagnostic feedback from the cardiologist. A medical chart review was conducted to determine diagnosis and relevant medical history for exclusionary purposes. Institutional review board approval for the study was obtained from the investigating university and medical school.

Instruments

Chest pain questionnaire. A chest pain questionnaire was used in this study to assess chest pain severity, time since onset, and number of episodes in the last month and was completed jointly by the parent and child. Participants responded to the question "Usually, how severe is the pain when you experience chest pain?" Usual level of NCCP was assessed on 10-point scale with verbal anchors of 1 = *no pain* and 10 = *extreme, worst pain imaginable*. Time since onset of pain was recorded in months. Recent examinations of verbal numeric scales have classified these as valid, reliable, and clinically useful assessment tools for gauging child pain severity (Bailey, Daoust, Doyon-Trottier, Dauphin-Pierre, & Gravel, 2010; Miró, Castarlenas, & Huguet, 2009).

HCU questionnaire. A HCU questionnaire was designed for this study to assess the extent to which children utilized different sources of health care including visits to the primary care physician, school nurse, emergency department, tertiary care specialist, and inpatient hospital admissions by reporting the number of visits for services during the last 12 months. Parents reported the number of visits for the child to each of these medical professionals or services. In prior research, parental reports of doctor visits and medical chart review have been shown to be in very good agreement (Craig, Cox, & Klein, 2002). Data was also collected on usage of mental health services. However, individuals reported infrequent, if any, use of psychological services, with only 12 children making one or more visits to a mental health provider of any kind (i.e., psychologist, psychiatrist, or counselor). Nine of these 12 made only one visit. Due to the low endorsement of their usage and current presentation to a medical setting, only visits to medical health care providers were included in further analyses.

Children's Depression Inventory (CDI). The CDI (Kovacs, 1992) is a 27-item child self-report inventory designed to measure

the severity of depressive symptoms during the past 2 weeks. Response options included: 0 (*absence of symptom*), 1 (*mild or probable symptom*), or 2 (*definite symptom*). The CDI has well-established psychometric properties. Internal consistency for this sample as measured via Cronbach's alpha was .88.

Multidimensional Anxiety Scale for Children (MASC). The MASC (March, 1997) was completed by the child to assess major dimensions of anxiety symptomatology. The 39 items were scored on a 4-point Likert scale ranging from 0 = *never true about me* to 3 = *often true about me*. Total score on the MASC was used for analyses. The MASC shows well-established psychometric properties and internal consistency for this sample was .87.

Symptom Checklist-90-Revised (SCL-90-R): Anxiety and depression subscales. Parents completed the SCL-90-R (Derogatis, 1977) to assess parental levels of anxiety and depression. Parents endorsed how much they were distressed by certain symptoms during the past 7 days on a Likert scale ranging from 0 = *not at all* to 4 = *extremely*. Consistent with the well-established psychometrics previously established for the SCL-90-R, internal consistency for this sample was .84 and .95 for the anxiety and depression subscales, respectively.

Results

HCU Characteristics

Preliminary analyses indicated no relationships between demographic variables and HCU. No differences in HCU or other variables of interest were found between the three cardiology clinic recruitment sites. No differences between the clinics were found on demographic variables except that families recruited from the more metropolitan site reported higher income. Children made between one and 36 visits to a medical health care provider in the 12 months prior to visiting the cardiologist ($M = 6.18$, $SD = 6.72$). Approximately 95.5% of children made one visit or more to the PCP, 40.3% to the school nurse, 31.8% to the emergency department, 26.9% to the tertiary care specialist, and 3.0% to the hospital. On average, children made 3.06 ($SD = 2.32$, range: 0–12) visits to the PCP, 2.12 ($SD = 4.56$, range: 0–20) visits to the school nurse, 0.56 ($SD = 1.13$, range: 0–6) visits to the emergency department, 0.36 ($SD = 0.78$, range: 0–4) visits to the tertiary care specialist, and 0.08 ($SD = .44$, range: 0–3) visits to the hospital. Due to a significant positive skew, a log transformation was performed, which resulted in the variable meeting the assumptions for performing hierarchical regression. The transformed variable was used in further analyses.

Children's Chest Pain Characteristics

The time since onset of chest pain ranged from 5 days to 10 years ($M = 13.78$ days, $SD = 21.41$). Children reported an average pain severity level of 5.78 ($SD = 1.88$, range: 2–10). Number of episodes per month was constrained to a maximum of 30 (i.e., average one per day) with a mean of 7.41 ($SD = 8.49$). Boys ($M = 5.64$, $SD = 1.65$) and girls ($M = 5.96$, $SD = 2.19$) did not differ in pain severity, $t(65) = -.69$, $p = .217$, time since the first episode (boys $M = 12.73$ days, $SD = 16.19$; girls $M = 14.53$ days, $SD = 24.67$; $t[65] = .155$, $p = .695$), or number of episodes in the

last month (boys $M = 7.71$, $SD = 9.73$; girls $M = 7.00$, $SD = 6.54$; $t(65) = .354$, $p = .724$).

Associations Among HCU, Child Sex, Pain, and Psychological Variables

Pearson correlations were performed between HCU, pain severity, and psychological variables. As indicated in Table 1, HCU was significantly and positively correlated with chest pain severity, child depression, maternal depression, and maternal anxiety. Time since the first episode of chest pain was not correlated with HCU ($r = .10$, $p = .934$) nor was number of episodes in the last month ($r = .224$, $p = .071$), and were therefore not included in further analyses. Additionally, child anxiety was excluded due to a lack of relationship with any variables aside from child depression. Child sex was examined using a point-biserial correlation and was not correlated with HCU. Although child sex was not correlated with HCU, child's sex was included in the regression model based upon existing literature indicating that it may have a significant influence, particularly as a moderating variable (Kaczynski et al., 2009; Keogh & Eccleston, 2006; Langer et al., 2007).

Hierarchical Regression Analyses for Prediction of HCU

Two hierarchical regression analyses were performed on centered variables to evaluate factors associated with variance in HCU. The first model examined the influence of child psychological factors and the second examined the contribution of parent psychological factors to HCU. Pain severity was entered on the first step for both regression models, because the aim of the study was to determine which factors beyond pain contribute to variance in HCU. In the second step, child or maternal depression and child sex were entered to examine the contribution of depressive symptoms to HCU. In the third step, the interaction of child sex and child or maternal depression was explored to determine if the relationship between depressive symptoms and HCU was moderated by the child's sex, because both children with pain and their parents have been shown to respond differently to pain, depending on the sex of the child.

The relationship between child depression and HCU was examined in the first model (see Table 2). Child pain was entered on the first step and accounted for 11% of the variance ($p < .01$). On the second step, child depression and child sex did not add significantly to the variance in child HCU ($\Delta R^2 = .05$, $p = .328$). The interaction of child sex and child depression was entered on the third step and contributed an additional 7% to the variation in HCU ($p < .05$). In the final model, pain severity, child depression, and the interaction of child sex and child depression were significant predictors, accounting for 20% of the variance in child HCU, $F(4, 65) = 3.91$, $p < .01$. Following the recommendations of Holmbeck (2002), moderational analyses examined the simple effects of the interaction for children with high (+1 SD) and low (-1 SD) levels of depression and followed procedures of Hayes and Matthes (2009) using their program (<http://www.afhayes.com/spss-sas-and-mplus-macros-and-code.html>). Results indicated that the slope was nonsignificant for girls, but significant for boys, $t(62) = 2.63$, $p < .01$. This interaction is shown in Figure 1. Girls utilized similar levels of HCU regardless of their level of depression, whereas boys with higher depression utilized more health care than those whose depression was lower.

In selecting factors for entry into the maternal model, maternal depression and maternal anxiety were highly correlated ($r = .77$, $p < .01$). Collinearity diagnostics indicated that these two variables reflected a similar construct and should not be included in the same model (Cohen, Cohen, West, & Aiken, 2002). Maternal depression had a stronger correlation with HCU ($r = .39$, $p < .01$), and therefore was selected for further analysis. Results from regression analyses for maternal depression are shown in Table 3. Consistent with the analyses for child factors, the child's pain severity was entered in the first step and accounted for 10% of the variance ($p < .05$). Child sex and maternal depression were entered in the second step and accounted for a significant increase in the proportion of variance explained ($\Delta R^2 = .10$, $p < .05$), with maternal depression being a significant contributor. When entered in the third step, the interaction of child sex and maternal depression accounted for a significant ($p < .05$) addition of 5% of the variance in HCU. In the final model, pain severity, maternal depression, and the interaction of child sex and maternal depres-

Table 1
Psychosocial Correlates of Child Health Care Utilization

Variable	1	2	3	4	5	6	7
1. Child health care utilization $n = 66$; $M = 6.18$, $SD = 6.72$; range: 0–36	—	.09	.33**	.26*	-.07	.39**	.30**
2. Child sex $n = 67$ (male = 0, female = 1)		—	.09	.14	.05	.00	-.14
3. Usual severity of pain $n = 67$; $M = 5.78$, $SD = 1.88$; range: 2–10			—	.30*	-.17	.30*	.18
4. Child depression—(CDI) $n = 67$; $M = 47.06$, $SD = 9.91$; range: 34–79				—	.27*	.47**	.45**
5. Child Anxiety—(MASC) $n = 66$; $M = 45.76$, $SD = 9.43$; range: 26–68					—	.11	.04
6. Maternal depression—(SCL-90-R) $n = 61$; $M = 50.54$, $SD = 12.09$; range: 37–79						—	.77**
7. Maternal anxiety—(SCL-90-R) $n = 61$; $M = 49.70$, $SD = 12.10$; range: 34–81							—

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

Table 2
Hierarchical Regression of Child Health Care Utilization and Child Factors

Child depression	B ^a	SEB ^b	β^c	R ²	ΔR^2	F
Step 1:				.11	.11	7.67**
Pain severity	.06	.02	.33**			
Step 2:				.14	.03	3.33*
Pain severity	.05	.02	.27*			
Child sex	.03	.08	.04			
Child depression	.01	.00	.18 [†]			
Step 3:				.20	.07*	3.91**
Pain severity	.06	.02	.33**			
Child sex	.02	.08	.04			
Child depression	.03	.01	.99**			
Child sex \times child depression	-.02	.01	-.87*			

Note. $n = 66$.

^a B = unstandardized coefficients. ^b SEB = standard error of unstandardized coefficients. ^c β = standardized coefficients.

* $p \leq .05$. ** $p \leq .01$. [†] $p \leq .10$.

sion were significant predictors, with the overall model accounting for 25% of the variance in the children's HCU, $F(4, 57) = 4.55$, $p < .01$. Moderational analyses examined the simple effects of the interaction of child sex and maternal depression for high (+1 *SD*) and low (-1 *SD*) levels of maternal depression using procedures recommended by Hayes and Matthes (2009). These results are illustrated in Figure 2. Analysis of the slopes showed that the only slope for boys was significant, $t(56) = 3.27$, $p < .01$. For girls, their HCU was similar at high and low levels of maternal depression. However, boys whose mothers were high in depression engaged in more HCU than boys whose mothers were low in depression.

Discussion

The purpose of this study was to examine biopsychosocial predictors of HCU in a sample of children with NCCP. Results suggest that chest pain severity, maternal depression, and child depression each contributed to the prediction of HCU. Additionally, the relationship between child depression and HCU, as well

as maternal depression and HCU, were moderated by the child's sex. The significant contribution of NCCP pain severity to the variance in HCU is consistent with prior research in idiopathic pain populations (Levy, Langer, Walker, Feld, & Whitehead, 2006; Roth-Isigkeit et al., 2005). Although some literature with community samples has identified differences in overall pediatric pain severity by sex, no differences were found in our sample with NCCP. This finding is consistent with other research in clinical settings. Specifically, both boys and girls who have reached the level of specialized tertiary care may report greater pain overall than those who present to a PCP, resulting in no significant differences by sex (Kaczynski et al., 2009; Lynch et al., 2007; Martin, McGrath, Brown, & Katz, 2007). Therefore, our sample of children with NCCP who presented to the cardiologist may represent the most severe cases of pediatric chest pain.

Child depression was also predictive of HCU, although a lack of longitudinal data does not allow examination as to whether depression is a precipitant, modulator, or perpetuator of pain and HCU. Depression and HCU may result from a common process, such as using maladaptive coping strategies (i.e., internalizing) that have been shown to contribute to both increased pain and depressive symptoms (Kashikar-Zuck, Goldschneider, Powers, Vaught, & Hershey, 2001; Kashikar-Zuck, Vaught, Goldschneider, Graham, & Miller, 2002). The child's sex moderated the effects of child depression on HCU. For girls, level of depressive symptoms was not associated with the amount of HCU. In contrast, boys with high levels of depressive symptoms utilized more than twice as many health care services compared with boys with lower levels of depression. In the literature, girls have been shown to use more internalizing and catastrophizing coping techniques for pain, and attribute pain to psychological processes, including their mood (Keogh & Eccleston, 2006; Lynch et al., 2007). As a result, parents and medical professionals may more easily identify co-occurring depressive symptoms in girls when they present with NCCP. In contrast to girls, boys more often attribute physical symptoms of pain, including idiopathic pain, to physical illness (Roth-Isigkeit et al., 2005). Therefore, at higher levels of depressive symptoms, boys with NCCP may complain of greater physical impairment as compared with girls due to their physical attributions, whereas girls may speak to their parents

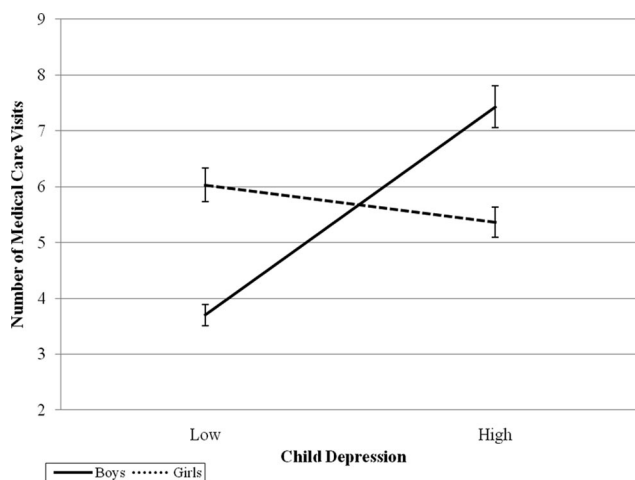


Figure 1. Moderation of HCU and child depression by child sex.

Table 3
Hierarchical Regression of Child Health Care Utilization and Maternal Factors

Maternal depression	B ^a	SEB ^b	β^c	R ²	ΔR^2	F
Step 1:				.10	.10	6.37**
Pain severity	.05	.02	.32*			
Step 2:				.20	.10*	4.57**
Pain severity	.04	.02	.22 [†]			
Child sex	-.01	.08	-.02			
Maternal depression	.01	.00	.32**			
Step 3:				.25	.05*	4.55**
Pain severity	.04	.02	.27*			
Child sex	-.02	.07	-.04			
Maternal depression	.03	.01	.99**			
Child sex × maternal depression	-.01	.00	-.71*			

Note. $n = 60$.

^a B = unstandardized coefficients. ^b SEB = standard error of unstandardized coefficients. ^c β = standardized coefficients.

* $p \leq .05$. ** $p \leq .01$. [†] $p \leq .10$.

about their pain in terms of mood symptoms. Parents would likely attend to and seek help differently based upon the child's expression of their own pain and mood symptoms, impacting health care-seeking behaviors. Additionally, girls are twice as likely as boys to report willingness to use mental health services, with greater parental disapproval and stigma reported by boys at the use of such services (Chandra & Minkovitz, 2006). Perceived stigma by boys toward the use of mental health services may result in greater utilization of medical health services when boys are experiencing pain and high levels of depressive symptoms.

For mothers, depression was positively associated with child HCU above and beyond the contribution of pain. Mothers of children with NCCP who have higher depressive symptoms take their children to the doctor more often. This finding is consistent with literature on children with abdominal pain (Levy et al., 2006). Research in other pain populations suggests that these behaviors may be part of an established pattern of inappropriate medical health care seeking associated with emotional and behavioral concerns that would likely be more effectively treated with psychosocial interventions (Campo et al., 2007). As was true in the

child model, the lack of longitudinal data prohibits us from ascertaining whether maternal depression preceded the child's pain and HCU, or occurred as a result of the child's continued pain. Although anxiety was not examined in the multivariate analyses due to concerns with multicollinearity between maternal anxiety and depression, maternal anxiety was strongly correlated with child HCU for children with NCCP. This is consistent with a review by Moran and O'Hara (2006) examining pediatric samples that shows maternal anxiety is associated with higher child HCU. Further research should attempt to eliminate issues of multicollinearity to delineate which factor (i.e., depression, anxiety) most strongly predicts child HCU in children with NCCP, as the literature suggests that maternal anxiety does play a role in HCU.

The interaction of the relationship between HCU and maternal depression by child's sex was also significant. Mothers with low or high levels of depression took their daughters for medical care at similar rates. However, mothers with high depressive symptoms took their sons for medical care twice as often as mothers who reported low levels of depression. Although the exact mechanisms influencing this process are unclear, we speculate that gender stereotypes of pain experiences may influence HCU, in that mothers typically see boys as "tougher" than girls and less sensitive to pain (Langer et al., 2007). Mothers who are more depressed may focus on negative events and may interpret their sons' pain in more catastrophic ways due to a violation of the gender stereotype (Beck, 2008). Additionally, mothers of children with pain have also been shown to be more protective of boys than girls when they interpret their child's condition to be severe (Langer et al., 2007). Further research on maternal factors and child's gender and sex in NCCP are needed to confirm this relationship with HCU.

In terms of limitations, as noted above, the study was cross-sectional in design and included a relatively small sample size. This precluded investigations as to whether the development of maternal and child depression preceded or followed the development of chest pain, as could be examined using a longitudinal design. Although this investigation examined the number of medical visits, no data were collected about the causes (i.e., for NCCP or other forms of illness) for prior medical visits in different health care settings or the outcomes of those visits. Although literature supports that parent report of medical

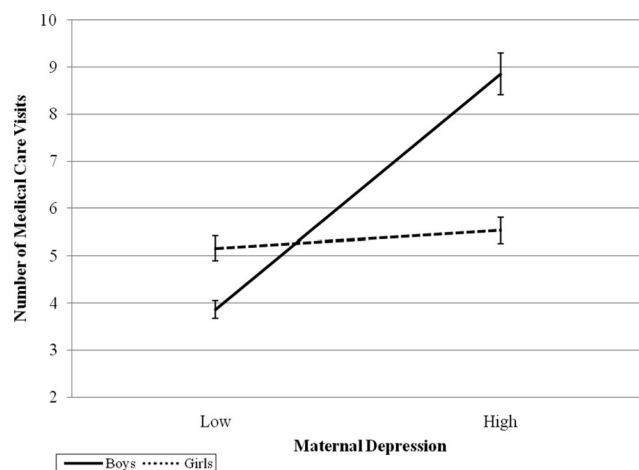


Figure 2. Moderation of HCU and maternal depression by child sex.

visits show good agreement with medical chart review (Craig et al., 2002), the current measure of HCU was not statistically validated and medical visits were not confirmed by formal chart review. There were no differences in HCU based upon ethnicity in this sample, contrary to prior literature suggesting non-Caucasians typically show less HCU than Caucasians (Flores & Tomany-Korman, 2008). Differences are usually related to discrepancies in access to care and insurance coverage (Nguí & Flores, 2007). All participants in this study had public or private health insurance coverage, which may have contributed to similar levels of HCU within the sample.

Additionally, while our data add to the literature on sex differences for patients with pain (Keogh & Eccleston, 2006; Langer et al., 2007), further investigation should be undertaken to confirm the generalizability of these findings to other pediatric pain patients. Our pain rating scale was completed jointly by parent and child and ranged from 1 to 10 rather than 0 to 10, which may limit the utility of our pain severity ratings in their ability to be directly comparable with those of other pain populations, but does not change the findings of this study. This study identified child sex as a moderator of HCU, but future research should endeavor to obtain a more precise understanding of the mechanisms underlying this finding. An understanding of both maternal attributions and the differential attributions of boys versus girls for their chest pain symptoms might shed light on how and why the children's sex and depressive symptoms interact. Additionally, parental gender-related expectations and child conformity to gender norms was not assessed and may play an important role in how parents respond to a child's pain. Although the lack of data from fathers is common in pediatric psychology, obtaining such data would broaden understanding into how family systems influence children's symptoms and HCU for patients with NCCP. Prior research with other pediatric populations has suggested that fathers may play an important role in a child's illness behavior and HCU (Blount, Morris, Cheng, Campbell, & Brown, 2004; Levy, Whitehead, Von Korff, & Feld, 2000).

Pain is often a warning sign of physical illness and should not be ignored. Appropriately, 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 the patients' chest pain. Their diagnostic workup indicates that for children with NCCP, their pain does not indicate cardiac illness. For some patients and parents, this assessment may be reassuring. For others, this reassurance may not be sufficient, particularly in light of the finding that for many patients with NCCP, their chest pain persists for 3 years following diagnosis (Lipsitz et al., 2004). Although not yet a part of the standard of care, evaluation of child and family psychological factors and HCU may prove instructive in identifying contributors to pediatric chest pain for many patients. The addition of psychological screening instruments in medical offices (e.g., Hayutin, Reed-Knight, Blount, Lewis, & McCormick, 2009) could facilitate the referring PCP's and cardiologist's ability to identify psychosocial contributors to patient's pain, and reduce future strain and unnecessary costs for the health care system. Additionally, the establishment of referral networks for families for whom further psychological assessment is indicated might aid in the provision of appropriate services. Pediatric literature shows that the occurrence of one somatic symptom predicts the occurrence of future somatic symptoms (Santalahahti, Aromaa, Sourander, Helenius, & Piha, 2005) and NCCP may be part of a larger pattern of attending to physiological arousal (Gilleland et al., 2009). For many patients with NCCP, it is therefore likely that physical symptoms and HCU for

these symptoms will continue until psychosocial factors are adequately assessed and treated by appropriate mental health professionals. In an already overburdened health care system, providing appropriate assessment and effective treatment could benefit patients with NCCP, and in turn, positively impact the sustainability of the health care system.

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