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Anxiety sensitivity and health-related quality of life in children with chronic pain

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Abstract

Anxiety sensitivity (AS), or the fear of anxiety sensations has been shown to independently predict poorer health-related quality of life (HRQOL) in adults with chronic pain. Specifically, AS was found to contribute to decrements in psychological well-being and social functioning but not to decrements in physical functioning. Existing studies have not examined the relationship between AS and HRQOL in children with chronic pain. The present study used multivariate regression analysis to test the association between AS and self-reported HRQOL in 87 children (62 girls; mean age = 14.4 years $\pm$ 2.3) presenting for treatment at a tertiary, multidisciplinary clinic specializing in pediatric chronic pain. After controlling for key sociodemographic and pain-related characteristics, higher AS was associated with poorer perceived general and mental health, greater impairment in family activities, lower self-esteem, increased behavior problems, and more social/academic limitations due to emotional problems. AS accounted for 4% – 28% of incremental variance in these HRQOL domains above and beyond the demographic and pain-related variables. However, AS was not significantly associated with physical functioning or with academic/social limitations due to physical health. Additional research is required to delineate possible mechanisms by which AS may influence certain aspects of children's HRQOL but not others.

Perspective—The present findings support the evaluation of AS in pediatric chronic pain patients as part of a comprehensive assessment battery. The links between AS and multiple HRQOL domains suggests that treatment components aimed at reducing AS may lead to enhanced psychosocial well-being in children with chronic pain.

Keywords

health-related quality of life; anxiety sensitivity; children; chronic pain; pain-related anxiety; functional impairment

Introduction

The concept of health related quality of life (HRQOL) refers to an individual's perceived mental and physical health over time and is often used to examine how chronic illness interferes with a person's daily life⁵. HRQOL is a subjective, multidimensional construct that relates to the individual's relevant life domains¹⁹. Numerous investigations have indicated that the experience of chronic, recurrent pain substantially impacts the daily life of children and

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adolescents^{8, 24, 26}, leading to decrements in physical^{8, 11}, psychological^{9, 10, 21} and social functioning^{11, 24}.

Relatively little is known however, about the factors influencing HRQOL in chronic pediatric pain. Whereas increased pain is associated with lower HRQOL^{8, 14, 22, 24}, pain characteristics have accounted for relatively small amounts of variance^{6, 8}. Studies among children with specific pain complaints have found that increased symptomatology predicted worse HRQOL in: irritable bowel syndrome (IBS)³⁶, arthritis¹, and recurrent headache^{14, 15}. Conversely, the ability to cope with pain and adaptive family routine predicted better HRQOL in children with headache⁷.

Two studies have examined predictors of HRQOL among adolescents with various chronic pain complaints—one found that poorer HRQOL was associated with pain characteristics⁸ (no other variables were examined); the other found that in addition to pain, self-reported vulnerability (e.g., feelings of inadequacy) and emotion-focused coping²² were strongly related to HRQOL. Depression^{9, 10, 16, 28}, pain catastrophizing^{18, 37}, and somatization³⁸, have also emerged as key correlates of impaired functioning in children with chronic pain; although mixed findings have been found for trait anxiety with one study reporting positive associations³⁸ and two reporting no associations^{28, 37} with functional impairment, an important aspect of HRQOL.

A related yet understudied construct in this regard is anxiety sensitivity (AS) or the tendency to view anxiety sensations as dangerous^{29, 32}. AS has been implicated in the experience of chronic pain in adults^{2, 25} and in children¹⁷. Previously, we found that AS contributed independently to pain-related anticipatory anxiety for laboratory pain in children, after taking anxiety symptoms into account³⁴, suggesting that AS is partially distinct from trait anxiety. Within the fear-avoidance model of chronic pain^{2, 3}, AS may play a crucial role in the onset and maintenance of chronic pain by enhancing the fear of pain leading to pain-related avoidance^{2, 3, 25}. Thus, it is conceivable that by increasing fear of pain and consequently more pain-related avoidance of activities, AS may contribute to greater impairment and worse HRQOL. Nevertheless, in the only study to examine the association between AS and HRQOL by Plehn et al. (1988)²⁷ in adults with chronic pain, AS predicted poorer psychological and social functioning, but not physical functioning. The authors speculated that despite the lack of a direct association between AS and physical functioning, AS may still play an important role in chronic pain since impaired psychological and social functioning may reduce treatment response and increase relapse rates²⁷.

Because there are no analogous investigations of AS and HRQOL in children with chronic pain, the present study aimed to test these relationships using the child form of the Child Health Questionnaire (CHQ-CF87)¹³, a well-validated measure of children's self-perceived physical and psychosocial well-being. Although the CHQ is a generic HRQOL measure and may therefore lack the sensitivity of condition-specific measures, the advantage of the CHQ is that it may be compared with population norms¹⁹. Following Plehn et al.²⁷, it was hypothesized that AS would demonstrate significant associations with psychological well-being and social functioning, but not physical functioning, after controlling for key sociodemographic and pain-related characteristics. We also explored the relationship between AS and general health, an aspect of HRQOL that has not been examined in previous research.

Materials and Methods

Participants

Participants were drawn from a larger sample of 175 children (122 girls, 69.7%) with a mean age of 14.2 years ($SD = 2.4$, range = 8–18 years). Children were patients presenting for treatment

at a multidisciplinary, tertiary clinic specializing in pediatric chronic pain. A subset of 87 children (62 girls, 71.3%) and a mean age of 14.4 years ($SD = 2.3$, range = 10-18 years) with complete data on the measures of interests were included in the current study. These children did not differ from those in the larger sample with incomplete data on the following characteristics: age, sex, race/ethnicity (Caucasian vs. non-Caucasian), pain intensity, pain duration, type of pain diagnoses, or presence of multiple pain diagnoses (yes/no).

For the 87 children in the current sample, presenting pain diagnoses were (note that percentages sum to more than 100% due to multiple pain diagnoses): 53.6% headaches (migraines; myofascial, vascular, tension, stress-related or other type of headaches), 39.3% functional neurovisceral pain disorder (functional bowel, uterine, or bladder disorder), 38.1% myofascial pain (of any part of the body excluding headaches), 8.3% fibromyalgia, 10.7% complex regional pain syndrome, type 1 or type 2 (CRPS-I; CRPS-II), 1.2% arthritis. Multiple pain diagnoses were present in 39.3% ($n = 33$) of the sample. Average duration of symptoms was 38.5 months ($SD = 43.9$, range = 2 - 213). According to parent report, in the past week children experienced pain: an extremely small part of the day (1 hour or less)(1.2%; $n = 1$); small part of the day (1-8 hours)(21.0%; $n = 17$); about half the day (9-14 hours)(11.1%; $n = 9$); most of the day (15-23 hours)(28.4%; $n = 23$); entire day (24 hours)(38.3%; $n = 31$); missing (6.9%; $n = 6$). Ethnic composition was: 69.0% Caucasian, 11.5% Latino, 1.1% African-American, 1.1% Asian American/Pacific Islander, 17.2% Other. Thus, 31% of the sample was non-Caucasian. Parents (78 mothers, 90.7%) had a mean age of 46.1 years ($SD = 6.7$, range = 30-67years). Highest level of parent education was: high school diploma or less 10.6%, some college or associates degree 27.1%, college degree 21.2%, post-graduate degree 41.1%. Institutional Review Board (IRB) approved written informed consent forms were completed by parents, and children provided written assent. All study procedures were approved by the UCLA IRB.

Procedure

Procedures for the administration of the questionnaire measures used in this study are described in detail elsewhere^{4, 33}. In brief, prior to children's initial clinic visit, two questionnaire packets, one for the child and one for a parent, were mailed to the home. Children and parents were instructed to complete the questionnaires separately without consulting one another. Families were instructed to bring the questionnaires with them to the initial clinic appointment. The time elapsed between questionnaire completion and the initial clinic appointment ranged from 2 to 175 days (mean = 45.8 days; $SD = 38.9$). During the appointment, a research assistant first reviewed the questionnaires to address missing or ambiguous responses (e.g., duplicate responses to the same item); clinicians later also reviewed the responses and asked parents and children to further clarify responses that were unclear. The questionnaires assessed demographic and general health information including measures of the child's pain, anxiety and functioning. Only those measures relevant to the current study are discussed below.

Study Measures

The Childhood Anxiety Sensitivity Index—(CASI)³⁰ is an 18-item scale that assesses the tendency to view anxiety-related bodily sensations as dangerous (e.g., “Unusual feelings in my body scare me;” “It scares me when I have trouble getting my breath”). It represents a downward extension of the adult measure, the Anxiety Sensitivity Index (ASI)²⁹. Items are scored on a 3-point scale (none, some, a lot). Total scores are calculated by summing all items. The CASI has shown good internal consistency ($\alpha = .87$) and adequate test-retest reliability (range = .62 - .78 over two weeks)³⁰. The CASI demonstrates strong correlations with measures of trait anxiety (r 's = .55 - .69) but also explains unique variance in fear that cannot be attributed to trait anxiety measures⁴⁰.

Pain Intensity—A 10-cm Visual Analogue Scale (VAS) was used to represent a continuum from no pain to unendurable pain. The VAS has been established and widely used as a reliable and valid measure of pain intensity with children^{20, 35}. This method measured the “usual” level of pain currently experienced by the child.

Child Health Questionnaire (CHQ CF-87)¹³—The CHQ CF-87 is a child-self report questionnaire designed to measure the physical and psychosocial well-being of children with and without chronic conditions. The CHQ is among the most widely used measures for children; reliability and validity tests have been extensive¹³. In a representative sample of children in the United States (U.S), the minimum criteria for item internal consistency ($\geq .40$) was exceeded on average by 94% of all item tests performed, and the average success rate for tests of item discriminant validity was 92%¹³.

The CHQ child form is comprised of 10 multi-item subscales: general health (GH)(e.g., “My health is excellent.”); physical functioning (PF) (e.g., “Has it been difficult for you to do tasks around the house due to health problems?”); limitations in school work and activities with friends due to physical problems (role functioning—physical/social) (RP) (e.g., “Has it been difficult to get schoolwork done or do activities with friends because of your physical health?”); limitations in school work and activities with friends due to emotional difficulties (role functioning—emotional/social) (RE) (e.g., “Has it been difficult to spend the usual amount of time on schoolwork or activities with friends because of problems like feeling sad or worried?”); limitations in school work and activities with friends due to behavioral difficulties (role functioning—behavior/social) (RB) (e.g., “Has it been difficult to do certain kinds of schoolwork or activities with friends because of problems with your behavior?”); behavior (BE) (e.g., “How often have you a hard time paying attention?”); mental health (MH) (e.g., “How much of the time did you feel unhappy?”); self-esteem (SE) (e.g., “How good or bad have you felt about your body and your looks?”); limitations in family activities (FA) (e.g., “How often has your health or behavior caused your family to cancel or change plans at the last minute?”); bodily pain (BP) (e.g., “How much bodily pain or discomfort have you had?”).

For each subscale, items are reversed when necessary and summed to attain raw scores which are then transformed into a 0-100 continuum. Higher scores on the CHQ subscales indicate better functioning. To avoid potential collinearity and to enhance method invariance, our analyses did not include the BP subscale since pain intensity was measured using the VAS described above. The BP scale was significantly correlated with the VAS ($r = -.28, p < .01$).

Demographics—Locally developed questionnaires completed by the parent assessed demographic information for children and parents including age, sex, race/ethnicity, and education.

Clinical Information—Information regarding the duration of pain symptoms, type of pain complaint(s), and number of pain diagnoses were derived from the patient's medical records via chart review. These items were obtained from the child and parent during the clinical intake interviews that contained core areas of assessment. These items were recorded in the assessment portion of the initial evaluation report completed by the evaluating physician and recorded in the patient's medical chart.

Results

Statistical Analysis

Bivariate analyses were used to examine the relationships among the variables prior to multivariate modeling. Independent t-tests and chi-square tests for continuous and categorical data, respectively were used to test for differences based on sex and race/ethnicity (Caucasian

vs. non-Caucasian) among the study variables. Comparisons between scores on the CASI and CHQ to normative values reported for non-clinical school children and comparative values reported other clinical populations were conducted using one sample t-tests. Pearson product moment correlation coefficients were generated to characterize the association between age and the study variables. An uncorrected α level of .05 (two-tailed) was used to evaluate these bivariate results (corrections to the α level were applied to the multivariate models—see below).

To test for potential redundancy among the CHQ subscales, Pearson correlations among the subscales were examined; these ranged from .09 to .65. The three highest correlations were between: 1) the BE and SE subscales ($r = .65$); 2) the BE and MH subscales ($r = .61$); 3) the SE and MH subscales ($r = .61$). Given that the correlations among the CHQ subscales all fell below .70, the cut-off that has been suggested as an index of multicollinearity³¹, multivariate analyses were conducted for each CHQ subscale separately.

For the confirmatory multivariate analyses, the independent variables were grouped into three categories, following Plehn et al²⁷. The first category consisted of demographics—age, sex (girls vs. boys, coded as “1” and “0” respectively), and race/ethnicity (Caucasian vs. non-Caucasian, coded as “1” and “0” respectively). The second category consisted of pain-related variables—pain duration, pain intensity, and multiple pain diagnoses (yes/no). The third category consisted of CASI total scores. Using sequential multiple regression analysis, each category of predictors was entered in the following order for each dependent variable: Step I - demographics, Step II - pain-related variables, and Step III - CASI scores.

The dependent variables consisted of 8 of the 10 CHQ subscales. As noted above, the BP scale was not included due to the overlap with the VAS pain intensity measure. Inspection of the distribution of the RB subscale indicated a substantially positively skewed distribution with a severely restricted range of scores—75.9% of children reported a maximum score of 100 on this scale indicating no limitations in school work or activities with friends due to behavioral problems. Transformations failed to normalize the distribution and thus, the RB subscale was excluded from the analysis. The remaining CHQ subscales met the assumptions for linear regression with one exception. The RE subscale evidenced a bimodal distribution such that assumptions for linear regression were substantially violated. For the RE subscale, 50.6% of children ($n = 44$) reported a maximum score of 100 indicating no limitations in school work or activities with friends due to emotional problems and 49.4% reported scores below 100. The RE subscale was therefore dichotomized into those reporting low and high RE scores and sequential logistic regression (with the above predictors entered in the same order) was used to examine these scores.

Separate regressions were conducted for each of the 8 CHQ subscales. Due to the large number of significance tests performed, a Bonferroni Step-Down (Holm's correction) was applied to the results of the 8 regression models to reduce the likelihood of Type I error. For each regression model, the p value for the overall model with all the predictors included was evaluated using this procedure. For those models found to differ significantly from zero using the Bonferroni-Holm's correction, the significance of individual predictor variables was evaluated using a standard probability level of .05. Two outliers with standardized residuals in excess of three standard deviations were identified—one outlier each for the MH and for the BE subscales. These outliers were excluded from the multivariate analyses of these two subscales.

Bivariate Results

Table 1 shows the descriptive statistics and reliability coefficients (Cronbach's alpha) for the questionnaire measures. In addition, Table 1 displays normative values for non-clinical school

children and comparative values for children with end stage renal disease¹² (CHQ) and recurrent medically unexplained chest pain¹⁷ (CASI). CASI scores in the current sample were significantly higher than those of non-clinical school children ($t(86) = 3.16, p < .01$) but were not significantly different from scores of children with chest pain. Scores for the CHQ in the current sample indicated significantly worse HRQOL compared to non-clinical school children on all subscales except for BE (PF - $t(86) = -7.79, p < .001$; RP - $t(86) = -8.83, p < .001$; GH - $t(86) = -9.67, p < .001$; RE - $t(86) = -3.04, p < .01$; SE - $t(86) = -8.32, p < .001$; MH - $t(86) = -6.25, p < .001$). CHQ subscale scores for the current sample were significantly lower than those of children with end stage renal disease for PF ($t(86) = -2.63, p < .05$) and RP ($t(86) = -4.20, p < .001$), indicating worse HRQOL in these two domains for the present sample. BE scores were significantly higher in the current sample compared to scores reported by children with end stage renal disease ($t(86) = 5.92, p < .001$). There were no other significant differences between the groups on the other CHQ subscales, i.e., GH, RE, SE and MH.

There were no significant sex differences in CASI total scores (girls, $M = 28.8, SD = 7.2$; boys, $M = 27.0, SD = 6.6$) and the CASI was not significantly correlated with age ($r = .001, NS$). CASI scores did not differ significantly between Caucasian ($M = 28.6, SD = 7.4$) and non-Caucasian children ($M = 27.7, SD = 6.3$). Similarly, there were no sex differences on any of the CHQ subscales. Only the GH ($r = -.37, p < .001$) and SE ($r = -.22, p < .05$) subscales were significantly correlated with age; older age was associated with lower functioning on these subscales. Non-Caucasian children scored significantly higher on the RP ($M = 66.7, SD = 38.5$) and the FA ($M = 70.9, SD = 20.9$) subscales than did Caucasian children (RP - $M = 48.5, SD = 33.7$; FA - $M = 50.7, SD = 23.8$) (RP - $t(85) = -2.22, p < .05$; FA - $t(85) = -3.25, p < .01$).

There were no sex differences with regard to age, pain duration, pain intensity, or presence of multiple pain diagnoses. However, there were significantly more Caucasian girls ($n = 48$) compared to non-Caucasian girls ($n = 14$) in the sample but no such differences among boys ($n = 12$ Caucasian boys vs. $n = 13$ non-Caucasian boys) ($\chi^2(1) = 7.20, p < .01$). Child age was not correlated with race/ethnicity, or any of the pain-related variables.

Multivariate Results

Using the Bonferroni-Holm's correction, the models for all the CHQ subscales except for physical functioning (PF) and role-physical/social (RP) were found to be significantly different from zero. Table 2 shows the results of the sequential multiple linear regression analyses for the CHQ subscales except for PF and RP. Results of the sequential logistic regression analysis for the role-emotional/social (RE) subscale are shown in Table 3.

General Health (GH)

For the GH subscale, entry of the demographic variables in Step I explained significant variance in scores. Confirming the bivariate findings, age was a significant predictor accounting for 16% of the variance with older age being associated with lower GH scores. The entry of the pain-related variables in Step II did not explain significant incremental variance in GH scores. However, the addition of the CASI in Step III resulted in a significant, incremental increase in the prediction in GH scores, explaining an additional 11% of the variance (see Table 2). Because lower scores on the CHQ indicate poorer functioning, the negative beta coefficient for the CASI in Table 2 denotes that higher CASI scores were associated with poorer perceived general health. Overall, age explained the largest amount of variance in GH scores, followed by the CASI. The complete model including all predictors explained 33% (26% adjusted) of the variance in GH scores.

Family Activities (FA)

For the FA subscale, the demographic variables explained significant variance in scores. Consistent with the bivariate findings, race/ethnicity was a significant predictor explaining 12% of the variance; being non-Caucasian was associated with higher FA scores. The pain-related variables did not account for significant incremental variance but the addition of the CASI in the final step explained significant, incremental variance in FA scores, accounting for 4% of additional variance. As shown in Table 2, higher scores on the CASI were associated with greater perceived impairments in family activities due to the child's health. Overall, race/ethnicity accounted for the greatest variance in FA scores, followed by the CASI. The full model containing all predictors explained 27% (20% adjusted) of the variance in the FA subscale (see Table 2).

Self-esteem (SE)

For the SE subscale, the demographic variables accounted for significant variance in scores. Confirming the bivariate findings, age explained 8% of the variance, with older age associated with lower SE scores. The pain-related variables did not explain significant incremental variance but entry of the CASI in the final step accounted for significant, incremental variance in SE scores, explaining 7% of additional variance. Table 2 shows that higher CASI scores were associated with lower self-esteem. Overall, age accounted for the largest amount of variance in SE scores followed by the CASI. The complete model with all predictors accounted for 24% (17% adjusted) of the variance in SE scores (see Table 2).

Mental Health (MH)

For the MH subscale, the demographic variables explained significant variance in scores with race/ethnicity accounting for 8% and age accounting for 5% of the variance. Being Caucasian and of older age were associated with lower MH scores. Entry of the pain-related variables in Step II did not explain significant, incremental variance but addition of the CASI in the final step resulted in a significant, incremental increase in the prediction of MH scores, explaining 23% of additional variance. As illustrated in Table 2, higher scores on the CASI were associated with worse perceived mental health. Overall, the CASI accounted for the greatest variance in MH scores followed by race/ethnicity and then by age. The full model including all the predictors explained 38% (33% adjusted) of the variance in MH scores (see Table 2).

Behavior (BE)

For the BE subscale, after the entry of the demographic and pain-related variables (neither of which accounted for significant variance in scores), the addition of the CASI in the final step yielded a significant, incremental increase in the prediction in BE scores, explaining an additional 28% of the variance. Table 2 shows that the CASI was the only significant predictor of BE scores with higher scores on the CASI being associated with more self-reported behavioral problems. The complete model with all predictors included explained 36% (29% adjusted) of the variance in BE scores (see Table 2).

Role-Emotional/Social (RE)

Results of the sequential logistic regression for the RE subscale, are presented in Table 3. There was a good model fit (discrimination among groups) ($\chi^2(8) = 14.44$; $p = .07$; Log likelihood = 94.18); the overall model explained 22% of the variance in group membership (Cox & Snell R^2). As shown in the Table, inclusion of the demographics and the pain-related variables in Steps I and II, respectively did not reliably improve model fit. However, entry of the CASI in the final step significantly improved model fit. The significant odds ratio (OR) in Table 3 indicates that a 1 unit increase in the CASI increased the likelihood of being in the low RE group by 1.18 units. Higher CASI scores were therefore associated with greater perceived

impairments in social and academic performance due to emotional problems. Overall classification rate for the model with all predictors included was 77.0%, with 70.0% of the high RE and 83.7% of low RE participants correctly classified.

Discussion

We hypothesized the AS would demonstrate significant relationships with psychological well-being and social functioning but not with physical functioning in this sample of children with chronic pain. Consistent with our hypothesis, after controlling for key sociodemographic and pain-related characteristics, elevated AS was associated with poorer psychological well-being, i.e., worse perceived mental health, lower self-esteem, and more behavior problems, as well as poorer social functioning, i.e., greater limitations in family activities and an increased likelihood of social/academic limitations due to emotional problems. As hypothesized, AS was not related to physical functioning or to limitations in school work/activities with friends due to physical problems. Moreover, our exploratory analysis revealed that elevated AS was related to poorer perceived general health, explaining 11% of incremental variance. Overall, AS was found to contribute independently to children's HRQOL in all but two of the eight domains examined, accounting for 4% – 28% of incremental variance above and beyond the demographic and pain-related variables (see Tables 2 and 3). AS accounted for the largest share of associated variance for the mental health domain, and AS was the only significant correlate of the behavior and role/social emotional domains. For general health and self-esteem, AS explained the second largest portion of associated variance after age; for family activities, AS explained the second largest amount of associated variance after race/ethnicity.

In contrast to previous work^{8, 14, 22, 24}, we found that pain-related characteristics, i.e., pain intensity, pain duration, and presence of multiple pain diagnoses, did not account for significant incremental variance in HRQOL after controlling for demographics. One possible explanation for this divergence relates to differences in pain assessment. Prior studies^{8, 14, 22} assessed pain characteristics using pain diaries; average pain intensity derived from pain diaries was found to be significantly lower than retrospectively estimated pain intensity from a single VAS score⁸. The latter method of pain assessment was used in the current study. The diary method may therefore yield more accurate estimates of pain⁸ and should be employed in future research on HRQOL. Another possibility concerns differences in sample composition. In previous work with adolescents reporting various chronic/recurrent pain complaints, the extent of care-seeking was unclear^{8, 22}. Our sample consisted of children whose parents were seeking care for their child at a tertiary specialty clinic for the treatment of chronic pain. Typically, these patients were referred from subspecialty clinics, and all had at least one formal pain diagnosis. The current sample also reported considerable impairment as evidenced by CHQ scores which, for all subscales except for behavior, were significantly lower than normative values (see Table 1). Moreover, the present sample reported lower CHQ scores, indicating greater impairment in physical functioning and role functioning due to physical problems than children with end stage renal disease. It may be that pain characteristics in this highly impaired sample were more restricted in range compared with that reported in prior studies which included both care-seeking and non-care-seeking adolescents.

Our findings are consistent with previous research demonstrating the salience of psychosocial factors in HRQOL among children with chronic pain²². Merlijn et al (2006)²² reported that vulnerability and emotion-focused coping were strongly associated with multiple domains of HRQOL. In contrast to the single subscale assessing social functioning in the Merlijn study, the CHQ includes three subscales assessing social/academic limitations due to physical health, emotional problems, and behavioral problems. As noted above, AS was not associated with the physical health dimension and we did not examine the behavioral dimension since 75%+ of children reported no such limitations due to behavioral problems. For limitations due to

emotional problems, our overall model explained 22% of the variance in group membership (high vs. low impairment). Notably, AS emerged as the only significant correlate with a 1 unit increase in AS increasing the likelihood of being in high impairment group by 1.18 units (see Table 3). These findings together with those indicating a significant link between AS and limitations in family activities suggest that elevated AS is associated with disruptions in social functioning both at home and at school.

Although AS was primarily related to psychological aspects of HRQOL, AS also accounted for significant incremental variance in perceived general health. Because prior work has not investigated the association between AS and general health perceptions, the factors that may modulate this link are unclear. As noted above, contrary to the fear-avoidance model^{2, 3} which holds that AS enhances the fear of pain which in turn amplifies pain-related avoidance, Plehn et al. (1998)²⁷ did not find significant associations between AS and physical functioning in their adult study. We replicated these negative findings suggesting that the relationship between AS and perceived general health may be independent of children's ability to engage in physical activities. Although reasons for our null findings are unclear, as discussed above, CHQ scores for physical functioning and role functioning due to physical problems in our sample were significantly lower compared to children with end stage renal disease. Thus, in this severely impaired sample, physical functioning appears to be influenced by other factors not measured in this study.

Our analysis revealed significant relationships between demographic characteristics and HRQOL. Older age was associated with poorer perceived general and mental health, and lower self-esteem—findings that are largely comparable with studies of school children¹² and children with chronic pain¹¹. We also found that non-Caucasian children reported fewer limitations in family activities and better perceived mental health than Caucasian children. Studies to date have not examined the impact of race/ethnicity on HRQOL in chronic pediatric pain, most likely because the majority of patients in tertiary pediatric pain clinics are Caucasian. Even in our sample, wherein roughly 30% were non-Caucasian, we were not able to examine individual racial/ethnic categories due to small cell sizes. The role of cultural influences in children's HRQOL warrants additional study.

Limitations to our findings should be mentioned. First, we did not collect other measures of psychological symptoms and thus could not assess the relative strength of the association between AS and HRQOL taking into account other psychological symptoms. Nevertheless, in additional analyses controlling for the presence of possible anxiety disorder as assessed by the evaluating physician at the initial intake and noted in the patient's medical chart, AS retained its significant association with all of the CHQ domains except for family activities. Moreover, the amount of incremental variance explained by AS did not change substantially in these analyses (general health: 10%; self-esteem: 5%; mental health: 21%; behavior: 26%). Although the assessment of possible anxiety disorder was not made using an established clinical interview measure and thus reliability could not be ascertained, all children were asked about anxiety symptoms by the evaluating physician. Whereas clear relationships between psychological symptoms (e.g., depression) and functional impairment have reported^{9, 10, 16, 28, 38}, there are no existing investigations on the associations between such symptoms and multiple HRQOL domains in pediatric chronic pain. Moreover, trait anxiety was unrelated to functional disability in two studies^{28, 37} (although positive findings were also reported³⁸), suggesting that different psychological symptoms may have varying impacts on HRQOL.

Second, our assessment of HRQOL was based solely on child self-report. In preliminary analyses for the current study, we did not find significant associations between child AS and parent reported HRQOL. In their comprehensive review, Matza et al.¹⁹ concluded that due to conflicting results, it is not possible to provide an empirically based, conclusive answer as to

whether the child or parent is best situated to assess the child's HRQOL. Further, Matza et al. stated that the use of child self-report is ideal, particularly with older children, since this approach is consistent with the definition of HRQOL which emphasizes individual's own subjective perspective¹⁹. Nevertheless, our findings may be at least partially explained by the use of a single informant (i.e., the child) and shared method variance (i.e., questionnaires to assess both AS and HRQOL). Third, the amount of incremental variance explained by AS was relatively small for certain HRQOL domains. However, it should be noted that AS was associated with HRQOL above and beyond demographic and pain-related characteristics that have traditionally been thought to influence HRQOL. Finally, our study was cross-sectional and causality cannot be inferred. Additional longitudinal studies should examine whether elevated AS promotes long-term decrements in HRQOL among children with chronic pain.

Our findings suggest that clinicians may consider evaluating AS in children with chronic pain as part of a comprehensive assessment battery. As noted by Plehn et al. (1998)²⁷ AS may play a key role in chronic pain since impairments in psychological well-being and social functioning may diminish treatment response and increase the likelihood of relapse. The inclusion of treatment components targeting AS may also lead to enhanced HRQOL in children. Recent work indicates that cognitive-behavioral therapy focused on reducing AS leads to significant reductions in pain-related anxiety in adult women with elevated AS³⁹. Understanding the complex links between AS and HRQOL may lead to the development of more targeted interventions aimed at improving the well-being of children with chronic pain.

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Table 1
Descriptive statistics for the questionnaire measures in the current sample, normative samples, and comparative clinical samples

Measure	Mean, Range in Current Sample (Standard Deviation)	Reliability Coefficient in Current Sample (Cronbach's Alpha)	Mean (Standard Deviation) from Normative Data ^a	Mean (Standard Deviation) from Comparative Clinical Data ^b
CASI	28.3, 29 (7.1)	.88	25.9 (5.2)**	29.5 (5.8)
PF	68.0, 96.3 (25.1)	.88	88.8 (14.0)**	75.0 (20.0)
RP	54.8, 100 (36.0)	.92	88.3 (21.0)**	70.4 (32.8)
GH	46.1, 96.7 (20.3)	.86	66.4 (14.6)**	47.3 (19.4)
FA	58.8, 100 (24.5)	.86	-- ^c	-- ^c
RE	75.8, 100 (31.4)	.90	85.9 (21.0)**	71.0 (31.2)
SE	66.0, 90.9 (18.9)	.89	81.8 (15.8)**	67.7 (19.1)
MH	62.1, 92.2 (16.2)	.88	72.7 (16.0)**	63.1 (18.0)
BE	78.1, 61.5 (12.5)	.78	76.6 (14.6)	70.3 (14.7)*
Pain intensity	6-4, 10 (1.8)	--	--	--

Note: CASI = Childhood Anxiety Sensitivity Index; PF = Physical Functioning; RP = Role Functioning - Physical; GH = General Health; FA = Family Activities; RE = Role Functioning - Emotional; SE = Self Esteem; MH = Mental Health; BE = Behavior; Pain intensity = VAS (0 -10), where 0 = no pain and 10 = unendurable pain.

^a Normative data for the CASI from Muris et al (2004)^{2,3} in non-clinical school children (N = 190); normative data for the CHQ from Landgraf and Abetz (1997) in non-clinical school children (N = 232).

^b Comparative clinical data for the CASI from Lipsitz et al (2004) in children with non-cardiac chest pain (N = 65); comparative clinical data for the CHQ from Landgraf and Abetz (1997) in children with end stage renal disease (N = 18).

^c Values for the Family Activities scale are not published since this scale was not fielded across all samples in Landgraf and Abetz (1997).

* significantly different from current sample at $p < .05$;

** significantly different from current sample at $p < .01$.

Table 2
Sequential Multiple Regression of Demographic, Pain-Related and Anxiety Sensitivity Measures on CHQ subscales

Step	Variables Entered	β	sr^2 (incremental)	Model R^2	Change in R^2
<u>General Health (DV)</u>					
1	Sex	.03	.00	.16	.16**
	Age	-.39**	.15		
	Race/ethnicity	-.08	.01		
2	Pain duration	.25*	.06	.21	.06
	Pain intensity	.03	.00		
	Multiple diagnoses	-.07	.00		
3	CASI	-.35**	.11	.33	.11**
<u>Family Activities (DV)</u>					
1	Sex	-.03	.00	.15	.15**
	Age	-.20**	.04		
	Race/ethnicity	-.36	.12		
2	Pain duration	.14	.02	.23	.07
	Pain intensity	-.19	.03		
	Multiple diagnoses	-.18	.03		
3	CASI	-.21*	.04	.27	.04*
<u>Self-Esteem (DV)</u>					
1	Sex	-.04	.00	.10	.10*
	Age	-.28**	.08		
	Race/ethnicity	-.18	.03		
2	Pain duration	.27*	.07	.17	.07
	Pain intensity	.02	.00		
	Multiple diagnoses	-.12**	.01	.24	.07*
3	CASI	-.26	.07	.31	.07*
<u>Mental Health (DV)</u>					
1	Sex	-.04	.00	.13	.13*
	Age	-.22*	.05		
	Race/ethnicity	-.31**	.08		
2	Pain duration	.11	.01	.15	.03
	Pain intensity	-.09	.01		
	Multiple diagnoses	-.13	.01		
	CASI	-.49**	.23	.38	.23**
<u>Behavior (DV)</u>					
1	Sex	.00	.00	.02	.02
	Age	-.13	.02		
	Race/ethnicity	-.01	.00		
2	Pain duration	.13	.02	.07	.06
	Pain intensity	.00	.00		
	Multiple diagnoses	-.23**	.05		
3	CASI	-.55**	.28	.36	.28**

Note: For Sex, boys and girls coded as "1" and "0," respectively; Race/Ethnicity = Caucasian vs. non-Caucasian, coded as "1" and "0," respectively; CASI = Childhood Anxiety Sensitivity Index; β -Standardized regression coefficient; sr^2 = incremental contribution of IV to R^2 ; Model R^2 = Coefficient of determination (goodness of fit) for overall regression model after entry of each independent variable; Change in R^2 = incremental contribution of an independent variable to R^2 in the total set of independent variables.

* $p < .05$;

$p < .01$
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Sequential Logistic Regression of Demographic, Pain-Related and Anxiety Sensitivity Measures on the RE subscale

Step	Predictor Variable	β	Odds Ratio	95% CI	χ^2 to remove	df
1	Sex	-.09	0.92	0.28 – 3.01	2.82	3
	Age	.04	1.04	0.84 – 1.30		
	Race/ethnicity	.78	2.17	0.67 – 7.06		
2	Pain duration	.00	1.00	0.99 – 1.02	3.90	6
	Pain intensity	-.09	0.91	0.69 – 1.21		
	Multiple diagnoses	.46	1.58	0.56 – 4.49		
3	CASI	.16**	1.18	1.08 – 1.29	20.77**	7

Note: CI = confidence interval; χ^2 to remove = improvement in model fit when predictor is removed; df = degrees of freedom.

* $p < .05$;
** $p < .01$.