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The interplay of pain-related self-efficacy and fear on functional outcomes among youth with headache

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Abstract

Pain-related self-efficacy and pain-related fear have been proposed as opposing predictors of pain-related functional outcomes in youth with chronic pain. Self-efficacy is a potential resiliency factor that can mitigate the influence pain-related fear has on outcomes in youth with chronic pain. Drawing from theoretical assertions tested among adults with chronic pain, this study aimed to determine whether pain-related self-efficacy mediates the adverse influence of pain-related fear on functional outcomes in a sample of youth with chronic headache. In a cross-sectional design of 199 youth with headache, self-efficacy was strongly associated with fear, disability, school impairment, and depressive symptoms. Pain intensity and self-efficacy were only modestly related, indicating level of pain has less influence on one's confidence functioning with pain. Self-efficacy partially mediated relationships between pain-related fear and both functional disability and school functioning but did not mediate the relationship between pain-related fear and depressive symptoms. These results suggest that one's confidence in the ability to function despite pain and fear avoidance both uniquely contribute to pain-related outcomes in youth with chronic headache. These results further suggest that treatment for chronic headache in youth must focus on not only decreasing pain-related fear but also on enhancing a patient's pain-related self-efficacy.

Perspective—Pain-related self-efficacy is an important resiliency factor impacting the influence of pain-related fear on functional disability and school functioning in youth with headache. Enhancing self-efficacy may be a key mechanism for improving behavioral outcomes. Clinicians

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can reduce pain-related fear and enhance pain-related self-efficacy through interventions that encourage accomplishment and self-confidence.

Keywords

pain-related self-efficacy; pain-related fear; mediation analysis; youth; headache

Headache is the most common complaint in pediatrics[36], with results of a recent systematic review indicating that 60% of children and adolescents worldwide experience headaches of varying frequency and duration[1]. The majority of pediatric headache patients continue to exhibit headaches up to 40 years after their initial presentation[6]. Thus, headaches are a persistent problem in youth[22]. Within the literature examining biopsychosocial stressors during pediatric chronic pain experiences, pain-related fear and pain-related self-efficacy have been identified as two important cognitive factors[8; 41].

According to the Fear-Avoidance Model of Pain[49], fear emerges when stimuli related to pain are perceived as threatening, with heightened fear leading to behavioral avoidance and increased disability. Disuse and depression may follow, fueling a cycle of more pain, fear, and disability. In this context, fear-avoidance has been characterized as a psychological risk factor for increased pain and diminished activity[7; 29]. By contrast, self-efficacy refers to the confidence an individual has regarding their ability to perform a particular behavior[4]. Pain-related self-efficacy consists of one's beliefs, while in pain, about abilities to function effectively[13; 8; 14]. Self-efficacy has been characterized as a protective psychological resource or resiliency factor associated with lower pain and better physical functioning in adults with chronic pain[54; 32; 45; 40].

Heightened pain-related fear has been associated with poor pain-related outcomes such as decreased functional disability and increased depression[42]. Pain -related self-efficacy has been associated with positive pain-related outcomes including better school attendance[20; 21]. Thus, understanding the effects of diminished pain-related fear and enhanced pain-related self-efficacy among youth suffering from chronic headache could improve their clinical care and promote strong, lasting health-related behavioral outcomes.

Research among adults experiencing chronic pain, particularly those with low back pain, has examined the mediating role of pain self-efficacy in the relationship between pain-related fear and chronic pain outcomes[13; 14; 53; 15; 11]. Several studies[53; 11] have shown that self-efficacy may have a more direct link than fear or avoidance of movement to pain and disability, prompting Woby and colleagues to propose a revised fear-avoidance model that directly incorporates the mediating role of self-efficacy[53]. In this modified model, it is suggested that avoidance behavior is likely to occur when pain-related fear leads to a reduction in functional self-efficacy whereas avoidance behavior is less likely to occur when pain-related fear does not lead to this kind of reduction. Their presumption is that self-efficacy can change, or weaken, the relationship between fear and pain-related outcomes through its function, specifically, as a mediator in the relations between pain-related fear and pain intensity and pain-related fear and disability.

The influence of pain-related self-efficacy within the context of the Fear-Avoidance Model of pain has yet to be examined in youth with chronic pain, including headache. If pain-related self-efficacy can be shown to be an important beneficial influence mitigating the negative effects of fear in youth with long-term pain, then self-efficacy could be a promising target in the development of interventions to improve functional outcomes for these youth. This study proposes that pain-related self-efficacy among youth with chronic headache will play a mediating role in relations between pain-related fear and pain-related disability. We hypothesize that pain-related self-efficacy, a demonstrated cognitive protective factor, will partially mediate the relationships observable between (1) pain-related fear and functional disability, (2) pain-related fear and school functioning, and (3) pain-related fear and depressive symptoms, thereby influencing both physical and psychological well-being in youth with chronic headache.

Method

Participants

All English-speaking patients 8 – 17 years of age who underwent a multidisciplinary pain evaluation for headache at a tertiary pediatric headache clinic in a large, urban northeast pediatric hospital between September, 2011 and May, 2013 were eligible for the study. One parent of each child also participated. Of the 234 children and adolescents and parents approached to participate in this study, 205 consented and 199 completed the pain-related self-efficacy measure for inclusion in these analyses, resulting in an 88% consent rate and 85% completion rate. All participants were evaluated at their first, or initial, contact with the clinic.

Measures

Pain-related self-efficacy—The Pain Self-Efficacy Scale (PSES-C)[8] is a 7-item measure assessing children's self-efficacy for functioning normally when in pain. Example items include "How sure are you that you can take care of yourself when you have pain?" and "How sure are you that you can do well in school when you have pain?" Items are scored on a five-point Likert scale with higher scores indicating poor self-efficacy. Initial validation provided support for the measure's validity and reliability[8]. In the current study, the coefficient alpha level of the total score was 0.90.

Pain-related fear—The 24-item Fear of Pain Questionnaire (FOPQ-C)[41] assesses children's self-reported perceptions of pain-related fears and avoidance behaviors. The FOPQ-C consists of 24 items and two subscales: Fear of Pain ("I worry when I am in pain"; 13 items) and Avoidance of Activities ("I avoid making plans because of my pain"; 11 items). Items are rated on a five-point scale from 0=strongly disagree to 4=strongly agree. Higher total scores indicate higher levels of pain-related fear and avoidance. The FOPQ-C has demonstrated validity and reliability.[41] In the current study, the coefficients alpha level of the total score was 0.94.

Pain intensity—During the pain evaluation, children were asked to provide their average pain rating on an 11-point verbal numeric rating scale from 0 (no pain) to 10 (most pain

possible). This is a reliable and valid method for obtaining children's self-report of pain in this age group[50].

Functional disability—The Functional Disability Inventory (FDI)[51] is a self-report scale that assesses children's difficulty in physical and psychosocial functioning due to physical health. The instrument consists of 15 items concerning perceptions of activity limitations during the past two weeks; total scores are computed by summing the items. Higher scores indicate greater disability. The FDI has demonstrated reliability and validity[10]. Alpha reliability for the current sample was 0.91.

School functioning—The Pediatric Quality of Life Inventory (PedsQL)[44] school functioning subscale is a five-item parent-reported measure of adolescent school functioning. Items all begin with the stem, "In the past one month, how much of a problem has your child had with …" and response options range from never (0) to always (4). Example items are "Paying attention in class" and "Keeping up with school work". Raw scores are then transformed into standard scores on a scale of 0–100, with higher scores indicating better functioning (less impairment). Alpha reliability in this sample was 0.86.

Depressive symptoms—The Children's Depression Inventory (CDI)[24; 25] is a well-validated 27-item self-report measure of children's depressive symptoms that has been widely used in pediatric pain studies. It is a recommended outcome measure for clinical trials in pediatric chronic pain[31]. Items are rated on a three-point scale from 0 to 2 and were summed to obtain a total score that was converted to a T-score. Higher scores indicated higher levels of depressive symptoms. Alpha reliability in this sample was 0.90.

Procedure

Participants were recruited during their multidisciplinary headache clinic appointment within a large tertiary children's hospital. The hospital's Institutional Review Board approved the study. Patients and their parents were approached by a research assistant during their evaluation and were asked to consent/assent both for this particular study and also if their responses to clinic measures could be used for research purposes.

Statistical Analyses

Data were analyzed with parametric tests using PASW 18.0 for Windows (SPSS Inc, Chicago, IL). Descriptive statistics including the means, standard deviations, and ranges were conducted to examine underlying assumptions of normality for all variables of interest. Internal consistency ratings were calculated as well. Pearson product moment correlations were used to examine relationships among the proposed outcomes and the mediator.

A regression analysis with Preacher and Hayes' bootstrap script[37] (with n=5000 bootstrap samples) (http://afhayes.com/spss-sas-and-mplus-macros-and-code.html) was employed to assess the indirect effects, specifying a 95% Bias Corrected and Accelerated Confidence Interval (BCACI)[55]. In assessing mediation with this method, the total effect (weight *c;* a regression coefficient) of an independent variable (IV) on a dependent variable (DV) is composed of a direct effect (weight c'*;* a regression coefficient) of the IV on the DV and an

indirect effect (weight $a \times b$) of the IV on the DV through a proposed mediator (M). Weight *a* signifies the effects of the IV on the M while weight *b* reflects the effect of the M on the DV, partialling out the effect of the IV. Mediation is demonstrated if the BCACIs do not contain zero. It is important to note that total mediation is not the goal, thus we tested for partial mediation. Average pain was entered as a control variable in the mediation analyses for all three proposed outcomes using Preacher and Hayes' bootstrap script.[37] In addition, age was included as a control variable in the same manner together with average pain in the mediation assessment for school functioning. Average pain, age, and gender were included likewise as control variables in the mediation assessment for depressive symptoms. Neither age nor gender was included as a control variable in the mediation analysis for functional disability because neither variable was significantly correlated with functional disability.[55]

Results

Participant characteristics

Basic demographic (e.g., age, gender) information was collected from patient charts (Table 1). Parents completing the study questionnaires were predominantly mothers (91%). Headache diagnoses assigned individually by one of three clinic-affiliated physicians who conducted the medical portion of the clinical evaluations for these participants were used, based on the International Classification of Headache Diagnoses-II (ICHD-II): migraine (25%); tension-type headache (24%); migraine and tension (23%); other primary headache disorders (largely new daily persistent headache), (12%); attributed to trauma or injury to the head/neck (8%); and other (e.g., occipital neuralgia; 8%). Duration of pain varied greatly from 1 month to 194 months, with median duration of pain 19 months. Included here are 11 patients (5.5% of the total sample) reporting a duration of pain less than 3 months; because of their referral to a tertiary care clinic, we consider, regardless of duration of pain, their headache diagnosis to be complex enough to be worthy of inclusion in these analyses. A large percentage of parents were well educated (i.e., college graduate or higher: 73% for mothers, 66% for fathers).

Preliminary analyses

Average pain was related to higher levels of pain-related fear, functional disability, and depressive symptoms. Age was related to higher levels of pain-related fear and depression and worse school functioning. Gender was related to higher levels of fear and depression. Pain intensity was modestly correlated with pain-related self-efficacy (Table 2). Pain-related fear was correlated with lower levels of pain-related self-efficacy, functional disability and depression. With regards to self-efficacy and our outcomes of interest, poorer self-efficacy was associated with higher levels of functional disability, depression, and worse school functioning.

Mediation Analyses

Does self-efficacy mediate the relation between pain-related fear and outcomes?—Figure 1 presents the bootstrap results of the mediation effect of pain-related self-efficacy on the pain-related fear-functional disability relationship. In the direct model, the pain-related fear-functional disability relationship (c path) was statistically significant. In

the mediation model, the pain-related fear-pain-related self-efficacy path (a path) was significant and the pain-related self-efficacy-functional disability (b path) was significant. With self-efficacy in the model, pain-related fear continued to be a significant predictor of functional disability (c' path). Bootstrapping results confirmed a partial mediation effect (β = .16; BCACI = .09 – .23). Pain-related self-efficacy partially mediated the pain-related fear-functional disability link in youth with chronic headache while controlling for average pain intensity. The same pattern of results emerged for school functioning with a partial mediation effect (β = −.19, BCACI = −.34 – −.05) (Figure 2). Pain-related self-efficacy partially mediated the relationship between pain-related fear and school functioning in youth with chronic headache while controlling for pain intensity and age. Results for depressive symptoms were somewhat different (Figure 3). When taking into account pain-related fear, the pain-related self-efficacy-depressive symptoms path (b path) was not significant. There was no evidence of mediation (β = .03, p < .001; BCACI = −.01 – .07) while controlling for pain intensity, age, and gender, thus not supporting our hypothesis.

Discussion

Psychological factors are well known to influence the development and maintenance of chronic pain[18; 27], including among youth experiencing chronic headache[19; 23; 52]. In the current study we examined whether self-efficacy, a demonstrated influential cognitive appraisal, may be a protective factor that can mitigate the influence of fear on negative functional outcomes (e.g., disability, depression) as has been observed in adult pain patients[53; 11]. If so, these results would suggest that one of the mechanisms by which fear exerts an influence on outcomes may be through one's confidence in performing activities, or lack thereof and could direct implications on how cognitive behavioral treatment is delivered among highly fearful pediatric headache patients. This is the first report testing the co-existing effects of fear avoidance and pain-related self-efficacy in youth with chronic pain.

Our hypotheses were partially supported, making our results consistent with previous findings, including those of Woby and colleagues, of a mediating role for self-efficacy in the relation between fear-avoidance and functional outcomes.[53] Self-efficacy partially mediated the pain-related fear disability and school functioning links and did not mediate the relation between pain-related fear and depressive symptoms. For global functional disability and for the more specific domain of school functioning, these findings demonstrate that both fear-avoidance and self-efficacy uniquely contribute to these outcomes providing two tangible targets for psychological intervention. Our results support a potential modification to the fear-avoidance model to include self-efficacy beliefs as a positive, *protective* factor expanding upon the current unelaborated 'confrontation' side of the model that can partially mitigate the inhibitory, or *risk* mechanisms more strongly associated with the negative development of disability and school impairment in children with chronic headache over time. The protective function of self-efficacy found in this study expands upon previous literature for individuals with chronic pain[54; 32; 40].

Our finding that pain-related self-efficacy failed to mediate relations between fear-avoidance and depressive symptoms suggests that pain-related self-efficacy may be more closely

related to pain specific functional outcomes than to emotional distress. In other words, a strong belief in one's ability to cope with pain may promote resilience in daily functioning but may not be sufficiently protective against psychological problems such as depressed mood, which may onset secondary to pain or may exist alongside but somewhat separate from the pain experience[33; 3]. It may be true as well in our research that, because self-efficacy was significantly associated with depressive symptoms at the bivariate level, whatever association that was there could be accounted for by the same underlying construct that pain-related fear is assessing (i.e. emotional distress). We do suspect from this research that pain self-efficacy is a more salient predictor of behavior, rather than mood, in youth experiencing chronic pain. We acknowledge that this conclusion is contrary to the findings of Sanchez (2011)[39], who reported depression as a significant predictor of self-efficacy in a sample of adults with fibromyalgia. This is likely due to the fact that they did not include pain-related fear in their evaluation of self-efficacy's impact on depressive symptoms that appears to usurp the influence of self-efficacy.

Among other findings, it was quite encouraging that pain intensity only modestly correlated with pain-related self-efficacy. This is contrary to previous findings that strongly associate pain intensity negatively with self-efficacy in adult chronic pain[43; 38; 13; 16]. This is more consistent with research that has found a nominal relationship between pain acceptance and levels of pain[26; 9; 17], suggesting that resiliency factors such as self-efficacy and pain acceptance can promote positive pain-related outcomes regardless of pain level.

Findings from this study clearly identify potential behavioral targets for clinician intervention. It is imperative to assess and treat both fear and self-efficacy in youth exhibiting chronic pain. Others have found that pain-related self-efficacy ratings are likely to improve following cognitive behavioral management of low back pain and that these changes are associated with better outcomes such as reduced disability[35; 2]. In terms of a specific type of treatment, it has been suggested that graded *in vivo* exposure therapies may be particularly effective types of treatment for youth with chronic pain. Gradually exposing fearful patients to activities that they perceive as threatening and/or harmful can lead to reductions in disability, fear of movement, and catastrophizing[46–48]. Successfully accomplishing a given task has been described as a method for increasing self-efficacy because it relates directly to the enhancement of personal mastery experiences[4; 5]. Directly exposing youth to activities during graded exposure to fear-eliciting activities may indirectly promote self-efficacy, in that it requires patients to engage in, and successfully accomplish, those same feared activities. Similarly, cognitive behavioral strategies demonstrated to be effective at treating chronic headache, enhancing levels of self-efficacy, and both diminishing catastrophizing and stress (e.g., mindfulness therapy[12], biofeedback[34], and stress management/relaxation therapy[28]) hold promise as effective therapies for youth with chronic headache. Clinicians should consider both reducing pain-related fear and enhancing pain-related self-efficacy through use of these cognitive-behavioral interventions that effectively promote adaptive functioning in daily life among youth.

There are limitations to the current study. We collected our data from self-report measures, which have limitations including social desirability bias[30] and shared method variance. Additionally, we recognize that our design was cross-sectional; thus, all uses of the term

'predictor' are as a statistical construct and cannot be interpreted as indicative of causality. Because our sample included only youth reporting headache as their primary pain problem, it also is unclear the extent to which the results can be generalized to a wider sample of youth reporting chronic pain more broadly. It is our view that longitudinal studies overcoming these limitations and investigating the extent to which self-efficacy mediates relationships between pain-related fear and outcomes like disability and mood over time in a wider group of chronic pain patients in more diverse clinical settings are warranted. Both observational and self-report measurement methods should be utilized in these subsequent studies.

Given that chronic headache is known to be a widespread and persistent complaint among youth world-wide, it is clear that resources should be allocated to further understand processes like self-efficacy that may promote lasting resilience in youth with chronic headache. Our work suggests that cognitive behavioral interventions that reduce chronic pain effectively should include an understanding of the effects of pain-related self-efficacy and fear-avoidance on the maintenance and exacerbation of functional disability and school impairment. Such intervention could improve long-term health and insure more lasting wellbeing among youth suffering from the debilitating effects of chronic or lasting headache.

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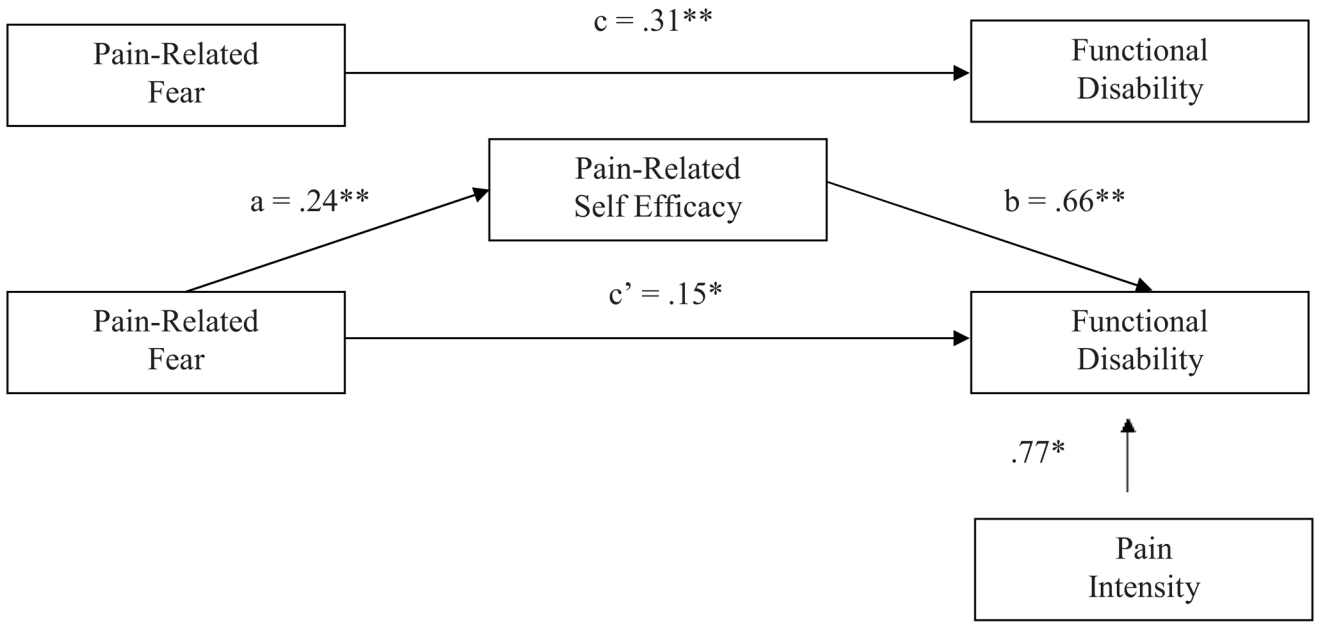

Figure 1.

Tests of the theorized mediation model for functional disability. *Upper figure*: the total effect (pain-related fear predicting disability). *Lower figure*: the indirect effect, with pain-related self-efficacy as mediator, and pain-intensity as a control variable. Indirect effect (β) = .16. Unstandardized regression coefficients are displayed. Bias-corrected and accelerated confidence intervals .09 – .23, CI95, bootstrap re-samples = 5,000. * p < .05, **p < .001.

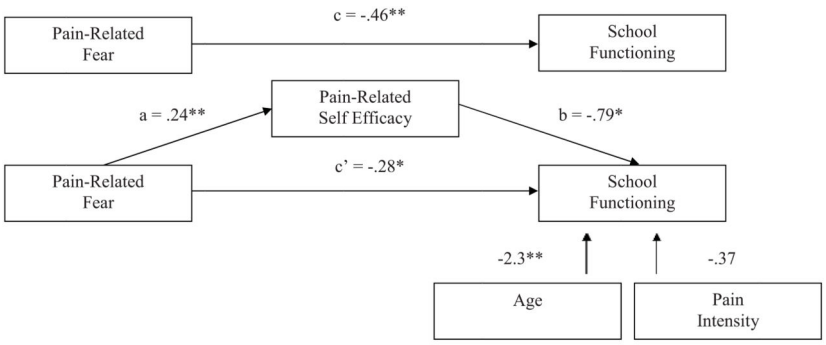

Figure 2.

Tests of the theorized mediation model for school functioning. *Upper figure*: the total effect (pain-related fear predicting school functioning). *Lower figure*: the indirect effect, with pain-related self-efficacy as mediator, and pain-intensity and age as control variables. Indirect effect (β) = −.34. Unstandardized regression coefficients are displayed. Bias-corrected and accelerated confidence intervals −.34 – −.05, CI95, bootstrap re-samples = 5,000. * $p < .05$, **$p < .001$.

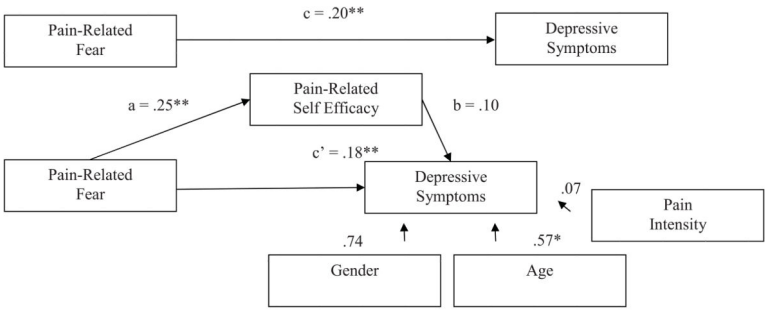

Figure 3.

Tests of the theorized mediation model for depressive symptoms. *Upper figure*: the total effect (pain-related fear predicting depressive symptoms). *Lower figure*: the indirect effect, with pain-related self-efficacy as mediator, and pain-intensity, age, and gender as control variables. Indirect effect (β) = .03. Unstandardized regression coefficients are displayed. Bias-corrected and accelerated confidence intervals −.01 – .07, CI95, bootstrap re-samples = 5,000. * $p < .05$, **$p < .001$.

Table 1

Participant demographic characteristics.

VARIABLE	RANGE	MEAN (SD)	FREQUENCY
Gender			
Male			27%
Female			73%
Ethnicity			
Caucasian			90%
African American			3%
Asian			2%
Hispanic			3.5%
Parent marital status			
Married			78%
Single			6%
Divorced/separated			14%
Spouse deceased			2%
Duration of pain (months)	1 – 194	34 (37)	

Table 2

Intercorrelations, means, standard deviations, and ranges for pain-related fear, pain-related self-efficacy, and disuse/disability.

Variable	1	2	3	4	5	6	7	N	M	SD	Range
1. Age (years)	--	0.12	.16*	0.06	0.14	−0.3**	.29**	199	13.8	2.53	**8 – 18**
2. Pain Intensity		--	.22**	.15*	.23**	−0.12	.15*	195	5.9	1.65	**2 – 10**
3. Pain-Related Fear			--	.68**	.54**	−.42**	.54**	199	37.3	18.82	**0 – 93**
4. Pain-Related Self-Efficacy				--	.59**	−.39**	.40**	199	19.5	6.52	**0 – 35**
5. Functional Disability					--	−.40**	.39**	194	17.5	10.98	**0 – 46**
6. School Functioning						--	.41**	189	52.7	22.43	**0 – 100**
7. Depressive Symptoms							--	195	9.32	7.63	**0 – 39**