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Changes in willingness to self-manage pain among children and adolescents and their parents enrolled in an intensive interdisciplinary pediatric pain treatment program

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Abstract

The importance of willingness to adopt a self-management approach to chronic pain has been demonstrated in the context of cognitive-behaviorally oriented interdisciplinary pain treatment programs for adults, both as a treatment outcome and as a process that facilitates functional improvements. Willingness to self-manage pain has not been studied in pediatric interdisciplinary pain treatment settings. Study aims were (1) to investigate willingness to self-manage pain among children and parents undergoing intensive interdisciplinary pain treatment and (2) to determine whether increased willingness to self-manage pain influenced functional treatment outcomes. 157 children ages 10-18 and their parents enrolled in a pediatric pain rehabilitation program completed the Pain Stages of Change Questionnaire (PSOCQ youth and parent versions) at pre-treatment, post-treatment, and short-term follow up. They also reported on pain, functional disability, depressive symptoms, fear of pain, and use of passive and accommodative coping strategies. Results show that willingness to self-manage pain increased during treatment among both children and parents, with gains maintained at follow-up. Increases in children's readiness to self-manage pain from pre- to post-treatment were associated with decreases in functional disability, depressive symptoms, fear of pain, and use of adaptive coping strategies. Increases in parents' readiness to adopt a pain-self management approach were associated with changes in parent-reported fear of pain but not with other child outcomes. Few associations emerged between pre-treatment willingness to self-manage pain and post-treatment outcomes. Findings suggest that interdisciplinary pediatric pain rehabilitation may facilitate increased willingness to self-manage pain, which is associated with improvements in function and psychological well-being.

Keywords

Chronic pain; Multidisciplinary Treatment, Parents; Pediatric Pain; Readiness to change

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Conflict of Interest

There are no conflicts of interest to report.

1. Introduction

Interdisciplinary rehabilitative treatment programs for children and adolescents with chronic pain are growing in number, with promising results of reduced pain and disability [8,17,20,24,29]. Typically these programs emphasize pain self-management, whereby patients are expected to participate actively in the rehabilitation process, assuming responsibility for their pain management and adopting more adaptive approaches to coping with pain. Program outcomes demonstrate reductions in functional disability and psychological distress [8,17]. With proliferation of this treatment model, there is increased emphasis on understanding predictors of successful treatment outcomes and identifying mechanisms driving treatment effectiveness.

Individuals' level of motivation, or readiness to adopt a self-management approach to pain, has emerged in adult pain research as an important factor in successful pain self-management. Readiness to change originates from the transtheoretical model of behavior change [22,23] which holds that individuals' readiness or motivation to engage in behavior change is a necessary antecedent to actual change. Jensen and colleagues [9] proposed a Motivational Model of Pain Self-Management (MMPSM), applying the construct of readiness to change to the context of chronic pain management.

In the adult literature, increased readiness to change is associated with improvements in pain and psychological functioning upon completion of multidisciplinary pain treatment [10,11,14], with evidence that gains are maintained at follow-up [11]. Readiness to change measured by the Pain Stages of Change Questionnaire (PSOCQ)[13] distinguished completers of an adult self-management focused pain treatment program from premature dropouts. Accordingly, assessment of readiness to change may help identify patients who will successfully engage in treatment. Furthermore, an important function of such treatment programs may be to help individuals adopt a greater willingness to self-manage pain.

The role of readiness to self-manage pain has not been well explored in pediatric pain treatment. In large part this is due to an absence of developmentally appropriate measurement tools. The recent validation of the adolescent PSOCQ and companion parent PSOCQ [6] allows for investigations of readiness to change both in pediatric chronic pain patients and their parents. Assessing parents' endorsement of a self-management approach to pain is crucial, because parents exert strong influences upon the child's pain experience and their engagement in treatment [6,25,26].

The aim of the current study is to explore children's and parents' readiness to adopt a self-management approach to pain as both as a target of treatment and as a predictor of outcomes in the context of intensive interdisciplinary pediatric pain rehabilitation.

Hypothesis I

Among children undergoing intensive interdisciplinary pediatric pain treatment and their parents, readiness to self-manage pain increases from pre- to post-treatment, with this increase maintained through initial follow up.

Hypothesis II

Increases in children's and parents' readiness to self-manage pain from pre- to post-treatment are associated with better treatment outcomes in terms of reduced disability, pain intensity, and psychological distress (depressive symptoms, fear of pain) along with decreased reliance on passive pain coping strategies and increased reliance on accommodative coping strategies.

Hypothesis III

Children's and parents' pre-treatment readiness to self-manage pain predicts changes in functional and psychological well-being over the course of treatment.

2. Methods

2.1 Procedure

2.1.1 Study Design—The study was a within subjects repeated measures cohort design set in an interdisciplinary rehabilitation program for Complex Regional Pain Syndrome and other neuropathic pain conditions. Data for this study are drawn from measures used for ongoing clinical assessment of psychological and functional status of all program participants. Pre-treatment data were collected via self-report questionnaires that families received within a week of program admission and brought with them on Day 1. Pre-treatment pain ratings were collected during Day 1 assessments. Post-treatment self-report questionnaires were given to families within two days of discharge, with post-treatment pain ratings taken within this time frame. Follow-up data were collected at one to three month post-discharge follow up. The study was approved by the hospital's institutional review board. Only program participants who provided written parental consent and child assent for study participation (96.3% of eligible families) had their data included in analyses.

2.1.2 Program description—The intensive interdisciplinary pain rehabilitation program is designed for patients ages 8-18 with persistent pain with significant impairment of mobility and daily function. The program entails intensive daily physical, occupational and psychological therapies eight hours a day, five days per week for a typical length of stay of three to four weeks. Patients receive psychological, physical (PT) and occupational therapies (OT) on an individual and group basis each day, along with daily medical management by a physician and nurse. Patients also complete home exercise programs at night and on weekends. Therapies focus on helping children return to premorbid functional status through a self-management approach to pain. Psychological therapy follows a cognitive-behavioral model. Families are actively incorporated into the program, with regular family therapy, parent support and education components, and structured family observations of PT and OT sessions. Psychological therapy targets include: 1) teaching a self-management approach to pain, 2) addressing negative thinking and fears about pain, 3) engaging in valued activities and relationships in the presence of pain, and 4) reducing parental attention and protective responses to pain. Throughout the program, the self-management of pain is emphasized, with increasing expectations of patients to assume responsibility for their pain management regimen (e.g. engaging independently in the HEP, tracking use of pain coping strategies using tools such as relaxation diaries, explaining the treatment rationale to parents during daily parent participation sessions). As children progress through the program they are given increasing levels of responsibility over their treatment regimen, e.g. selecting which physical exercises to complete in a given PT session or identifying specific cognitive-behavioral pain-management skills that are most effective for them. See Logan and colleagues [17,18] for additional details on the program and initial functional outcomes. Program participants returned for clinical follow-up one to three months after discharge from the program. Follow up visits included assessments by each program discipline (psychology, medicine, PT, OT) with feedback provided to patients and families regarding current functioning and recommendations offered regarding changes in self-management and professional interventions if warranted.

2.2 Participants

The sample is comprised of 157 children and adolescents (henceforth abbreviated as "children") ages 10-18 years (mean age = 14.7 years, SD = 2.1 years). The sample was

predominantly female (86.4%) and Caucasian (98%), consistent with the demographics of the patient population in the day hospital program. All participants had neuropathic or musculoskeletal pain with significant functional disability and restricted mobility. Primary pain location was a single lower extremity for 52.9% of the sample, bilateral lower extremities for 12.7% of the sample, one or both upper extremities for 3.2% of the sample, a combination of upper and lower extremities for 26.8% of the sample, and back for 3.8% of the sample. At the outset of treatment, participants reported prior healthcare utilization in terms of previous pain-rated medical visits ranging from 1-35 previous medical providers seen, with a median of five different physicians consulted. Parents, primarily mothers, also participated.

A total of 173 children enrolled in the interdisciplinary pain rehabilitation program between June 2008 and February 2011. Of these, 163 were between the ages of 10-18, and 157 consented to participate in the study. Of the 157 consented participants, 144 children completed the PSOCQ-A and 148 parents completed the PSOCQ-P pre-treatment; 135 children and 139 parents completed the measure post-treatment. A subset of the enrolled participants ($n = 40$) had participated in a prior single time point study of 350 children with chronic pain assessing fear of pain and related constructs, including readiness to change [see 19,25,28]. Participation in that study occurred at the time of initial visit to a pediatric chronic pain outpatient program and prior to participants' admission to this intensive treatment program.

2.3 Measures

2.3.1 Pain Stages of Change Questionnaire for Adolescents (PSOCQ-A) and Parents (PSOCQ-P) [6]. The adult pain stages of change questionnaire [13] based on the transtheoretical model of change was adapted to assess youth's readiness to adopt a self-management approach to pain and parents' own levels of readiness to adopt this approach. PSOCQ-A yields three validated subscales: *Precontemplation*: Little perceived personal responsibility for managing pain; *Contemplation*: Awareness of personal responsibility for pain management, considering behavioral change; *Action/Maintenance*: Active involvement in learning or continued use of self management strategies. PSOCQ-P yields four validated subscales: Precontemplation, Contemplation, Action, Maintenance. The measure has demonstrated reliability and validity [6]. In the current sample, coefficient alphas for the PSOCQ-A subscales at pre-treatment were .71 for Precontemplation, .88 for Contemplation, and .90 for Action/Maintenance. Coefficient alphas for the PSOCQ-P subscales at pre-treatment were .70 for Precontemplation, .82 for Contemplation, .81 for Action, and .88 for Maintenance. Because the PSOCQ-A was validated on a sample of children ages 12 and older while our sample included children as young as 10 years old, we examined the measure's internal consistency separately for children under age 12 in the sample ($n = 21$ of the total 157 participants). On the PSOCQ-A, all coefficient alphas were in the acceptable to excellent range (ranging from .72 to .94) for this small subset of participants.

2.3.2. *Pain Intensity* was assessed on an 11 point numeric rating scale (NRS), where 0 = no pain and 10= worst possible pain. Reports of current pain intensity were used. The NRS is a valid measure of pain severity in children [31].

2.3.3. *Functional Disability Inventory* (FDI [32]) is a well-validated 15-item scale that assesses children's self-reported difficulty in physical and psychosocial functioning due to their physical health. The instrument consists of 15 items concerning perceptions of activity limitations during the past two weeks that are rated 0="no trouble", 1="a little trouble", 2="some trouble", 3="a lot of trouble", and 4="impossible". A total summary score was used in analyses (range 0-60). Higher scores indicate greater disability. The FDI has demonstrated reliability and validity in children ages 8-18 [4,12,32].

2.3.4. Children's Depression Inventory (CDI [15]) assesses number and severity of depressive symptoms in children including symptoms of negative mood, anhedonia, interpersonal problems, and ineffectiveness. The CDI contains 27 self-report items representing depressive symptoms experienced within the last 2 weeks. Items are rated on a 3-point scale (rated 0-2) and summed to obtain a total score, with higher scores indicating more depressive symptoms. T-scores were used in analyses (range 34-100). The CDI has been found to have adequate reliability and validity for children ages 7-17.

2.3.6 Fear of Pain Questionnaire (FOPQ-C and FOPQ-P [28]); assesses pain-related fears and avoidance behaviors. The child report, FOPQ-C, consists of 24 items and two subscales: Fear of Pain and Avoidance of Activities while the parent report, FOPQ-P consists of 23 items and three subscales: Fear of Pain, Avoidance of Activities, and School Fears. Items are rated on a 5-point scale from 0= strongly disagree to 4= strongly agree. Higher scores indicate higher levels of pain-related fear and avoidance. These measures have strong internal consistency and construct validity is supported with the FOPQ-C strongly associated with child somatization, anxiety, catastrophizing, and functional disability, while the FOPQ-P is associated with parent pain catastrophizing and higher child healthcare utilization.

2.3.7 Pain Response Inventory (PRI [33]): Pain coping strategies were assessed with the Pain Response Inventory, a 60 item measure of passive, active, and accommodative coping strategies. The Passive Coping subscale, comprised of 15 items reflecting specific strategies such as self-isolation, activity restriction, and pain catastrophizing, was used to represent a non-adaptive approach to coping with pain. The Accommodative coping scale, comprised of items reflecting strategies of acceptance, self-encouragement, minimizing pain, and distracting or ignoring pain was used to represent an adaptive coping style. The active coping subscale score was not used in analyses, given inconsistent patterns of associations found with this PRI subscale in previous studies [26]. The subscales included in the current study are well-validated and found to be reliable among children with a broad range of pain complaints. [33,26]. Items are rated on a 5-point scale (0="never," 1= "once in a while," 2= "sometimes," 3= "often," and 4= "always") with higher scores indicating greater use of that coping style.

2.4. Data Analysis Plan

2.4.1 Data reduction strategies—To conceptualize "readiness to change" as a single variable (for testing Hypothesis 2), we focused on scores on the highest stages of the PSOCQ, those that indicate the respondent is actively involved in initiating or maintaining a self-management approach to pain. This decision was based in part on the fact that the Precontemplation subscale was noted to be somewhat unstable in the validation study of both the youth and parent versions of the PSOCQ, with relatively lower factor loading and internal consistency estimates. That study called for caution in the use of this subscale pending further testing of the measure. Furthermore, the Contemplation subscale of the measure has been found to be difficult to interpret in the context of intensive pain rehabilitation treatment [10,11]. The validation of the youth version of the PSOCQ found that a single subscale combining action and maintenance was more stable and reliable than separate subscales [6]. For ease of comparison, we created a parallel composite Action/Maintenance score for the parent PSOCQ, following Jensen's [11] strategy of averaging the scores on the two separate subscales into a single score. (Cronbach's alpha for this combined parent Action/Maintenance subscale at pre-treatment was .83 for the full sample).

2.4.2 Assessing change in readiness over course of treatment and beyond—Following procedures based on Jensen and colleagues' study [11] in adult multidisciplinary pain programs, six repeated measures ANOVAs using PSOCQ stage for each reporter as

dependent variables and time (pre-treatment, post-treatment, and follow up) as the independent variable were conducted. The repeated measures ANOVAS were followed with paired T-tests comparing pre-treatment to post-treatment and pre-treatment to follow up for each PSOCQ subscale score.

2.4.3 Testing associations between changes in readiness and changes in functional/emotional status—To assess concurrent associations in the extent of change in readiness to self-manage pain and improvements in functional and emotional status with treatment, we conducted a series of hierarchical linear regression analyses. Readiness to change was operationalized through scores on the Action/Maintenance composite subscale of the PSOCQ, with higher scores indicating greater endorsement of pain self-management approaches. Separate regression analyses were conducted for the following outcomes: functional disability (FDI scores), depressive symptoms (CDI scores), child fear of pain (FOPQ-C scores), passive coping (PRI passive coping scores), accommodative coping (PRI accommodative coping scores) and parent fear of pain (FOPQ-P scores). In each regression equation, pre-treatment Action/Maintenance scores and pre-treatment functional or emotional outcome scores were entered on the first step. On the second step of the equation we entered Action/Maintenance scores at post-treatment. Child and parent readiness to change were assessed in separate analyses to avoid effects of multicollinearity.

2.4.4 Associations between baseline readiness to change and changes in functional/emotional status with treatment—Bivariate correlations were computed to examine associations between each PSOCQ subscale score at pre-treatment and the extent of change in each outcome of interest (FDI scores, CDI scores, FOPQ scores, passive coping, accommodative coping) from pre-treatment to post-treatment. Change scores on all functional and psychological outcome variables from pre-treatment to post-treatment were calculated for the purposes of these correlational analyses.

3. Results

3.1 Descriptive findings of participants and their pain conditions

The median length of stay in the rehabilitation program was 3 weeks, with a range of 2 to 10 weeks. Average pain intensity at pre-treatment on the 0-10 VAS was 6.3 (SD = 2.3). Regarding functional disability at pre-treatment, 3.4% of the sample had minimal disability, 37.4% had moderate disability, and 59.2% had severe disability as measured by the FDI [12]. Means and standard deviations of the outcome variables of interest are reported in Table 1. (Means and standard deviations of each PSOCQ subscale across time points are included within Table 3.)

3.2 Changes in child and parent readiness to self-manage pain

Figures 1 and 2 depict scores on each PSOCQ subscale at pre-treatment, post-treatment and follow-up for children and for parents. Follow-up data were collected within a range of 2-18 weeks after program discharge (median = 10 weeks). At pre-treatment (n = 144) 33.3% of children were classified with a primary PSOCQ stage of Precontemplation; 41.7% were classified in the Contemplation stage; and 25% were classified in the Action/Maintenance stage. At post-treatment (n = 131), 4.6% of children were classified in the Precontemplation stage; 11.5% were classified in the Contemplation stage; and 84% were classified in Action/Maintenance. At follow up (n = 106), 5.7% of children were classified in the Precontemplation stage; 8.5% were classified in the Contemplation stage; and 85.8% were classified in Action/Maintenance. Among parents at pre-treatment (n = 144), 4.9% were classified in Precontemplation; 40.3% were classified in the Contemplation stage; 38.9% were classified in the Action stage; and 16% were classified in the Maintenance stage. At

post-treatment ($n = 136$), 0% of parents were classified in Precontemplation; 5.9% were classified in the Contemplation stage; 39.7% were classified in the Action stage; and 54.4% were classified in Maintenance. At follow up ($n = 102$), 0% of parents were classified in Precontemplation; 5.9% were classified in the Contemplation stage; 22.5% were classified in the Action stage; and 71.6% were classified in Maintenance. Child and parent scores on each PSOCQ subscale at each time point were significantly correlated with the exception of Contemplation scores at pre- and post-treatment time points (see Table 2).

Repeated measures ANOVAS of PSOCQ scores across the three time points revealed statistically significant changes over time. T tests confirmed that changes were in the expected directions (decreased Precontemplation, increased Action/Maintenance scores) for all subscales across reporters, with the exception of child Contemplation scores. Child Contemplation scores remained unchanged from pre-treatment to post-treatment but do show a statistically significant decrease from pre-treatment to follow-up. Parent Contemplation scores decreased at each subsequent time point relative to pre-treatment. See Table 3.

3.3. Associations between change in readiness to self-manage and changes in functional/emotional status

Hierarchical linear regression equations with child Action/Maintenance scores at post-treatment as the predictor of interest (controlling for pre-treatment Action/Maintenance scores and pre-treatment scores on indicators of functional/emotional status) show a number of significant associations (see Table 4). Briefly, an increase in readiness to change (i.e. child Action/Maintenance scores) at post-treatment is associated with decreases in functional disability, depressive symptoms, fear of pain, and reliance on passive coping strategies and with increases in reliance on accommodative coping strategies. Contrary to hypotheses, there were no significant associations between increased readiness to change and improvements in pain intensity scores at post-treatment.

Parent readiness to change was also examined as a potential predictor of key treatment outcomes, specifically parent-report of fear of pain and child reported functional disability and pain scores. Increases in parent Action/Maintenance scores over the course of treatment were significantly associated with decreases in parent-reported fear of pain during treatment (Model change in R^2 with post-treatment Action/Maintenance score added = .14, $P < .001$; post-treatment parent Action/Maintenance score $B = -4.07$, $T = -5.75$, $P < .001$). However, associations between changes in parental willingness to adopt a self-management approach to pain and changes in child disability and child's pain intensity were not statistically significant.

3.4 Associations between pre-treatment readiness to self-manage pain and changes in functional and psychological well-being over the course of treatment

Few significant correlations were found between child readiness to change at pre-treatment and treatment outcomes including change in functional disability, depressive symptoms, fear of pain, and passive and accommodative coping (all representing change from pre- to post-treatment). Child Contemplation scores at pre-treatment correlate with changes in functional disability ($r = .21$, $P < .05$) and fear of pain ($r = .35$, $P < .001$) during treatment, such that higher Contemplation scores at pre-treatment correlated with greater reduction in functional disability and fear of pain from pre- to post-treatment. Pre-treatment child Precontemplation scores also correlate with changes in fear of pain ($r = .22$, $P < .05$) such that higher pre-treatment Precontemplation scores correlated with greater reduction in fear of pain over the course of treatment. No significant correlations were observed between pre-treatment parent readiness to change scores and functional outcomes.

4. DISCUSSION

Results of this study indicate that participation in intensive interdisciplinary pediatric pain rehabilitation is associated with increased willingness to self-manage pain. Specifically, we observed decreases in Precontemplation scores and increases in Action/Maintenance scores for both children and parents from pre- to post-treatment, with changes maintained at 1-3 month follow-up. These findings are similar to previous reports of adult patients undergoing multidisciplinary pain treatment [10,11,14]. This is the first known study to demonstrate this effect among children and their parents in the context of pediatric pain rehabilitation. Results support the Motivational Model of Pain Self-Management (MMPSM) [9] in a pediatric population and suggest that motivation to self-manage pain increases among both children and parents as they undergo cognitive-behaviorally oriented interdisciplinary pain rehabilitation.

Similar to previous findings in the adult literature [10], Contemplation scores remained unchanged over the course of treatment and in fact declined from pre-treatment to follow-up. Although this is contrary to the MMPSM's theoretical assertion that the Contemplation scale represents motivation for self-management, Jensen and colleagues [10,11] concluded that Contemplation subscale items may more accurately represent ambivalence towards change rather than motivation for change. Additionally they suggest that Contemplation items may be interpreted differently depending on the timing of administration [11]. For example, children and parents may not endorse "I am *beginning* to wonder if I need to get some help to develop skills for dealing with my pain" at discharge from pain rehabilitation treatment, a time when they are likely to feel they have already made significant positive behavioral changes.

Beyond identifying patterns of increasing willingness to self-manage pain over the course of treatment, we found that increased willingness to adopt a self-management approach to pain is associated with better treatment outcomes. Increases in Action/Maintenance scores were associated with reductions in functional disability, depressive symptoms, fear of pain and use of more adaptive coping strategies at program completion relative to pre-treatment, consistent with findings in the adult literature [10,11,13,14]. Interestingly, in the current pediatric sample increased readiness to self-manage pain did not predict decreases in pain intensity, contrary to findings in studies of adult pain rehabilitation participants [11,14]. Previous pediatric chronic pain studies have found discrepancies between extent of injury, pain severity and functional status and timing of improvements in these domains [2,5].

Based on wide recognition that parent attitudes and responses impact child outcomes. [3,25,26,30] we examined parent readiness for change as a potential predictor of treatment outcomes. As hypothesized, parents' willingness to adopt a self-management approach to pain for their child increased during treatment, with this change maintained at follow-up. However, increased parental readiness for pain self-management generally did not predict treatment outcomes; the only significant association that emerged was that between increased parent Action/Maintenance scores and decreases in parent-reported fear of pain. This finding suggests that as parents feel more confident regarding their child's ability to take a self-management approach to pain, they express fewer fears regarding their child's pain experience. However, the lack of significant associations between parent willingness to self-manage pain and child outcomes may suggest that child readiness to self-manage pain is more directly linked to positive treatment outcomes than is parents' readiness. Given that the patterns of bidirectional influence are likely quite complex, longitudinal research is needed to understand how parent and child readiness may interact with one another in the context of pain treatment and beyond. Future research should also focus on parent's own outcomes following their child's participation in intensive pain rehabilitation programs. Although

investigation of changes in parents' mental health, parental thoughts and behaviors related to pain, and overall family functioning were beyond the scope of the current study, they are important directions for subsequent studies.

With a few exceptions (higher Precontemplation and Contemplation scores pre-treatment predicting greater reductions in fear of pain post-treatment), child and parent pre-treatment readiness to change failed to predict many of the treatment outcomes of interest in this study. Similar non-significant findings among adults are reported by Kerns and Rosenberg [14], leading those researchers to conclude that increases in willingness to self-manage pain over the course of cognitive-behaviorally oriented pain rehabilitation are more crucial to positive treatment outcomes than is pre-treatment level of readiness. Furthermore, in this pediatric setting there were generally low pre-treatment levels of Precontemplation, likely due to the degree of effort and self-advocacy required to be admitted into treatment (e.g. previous engagement in outpatient assessments and treatments, negotiations with insurance providers). Hence it is not surprising that most families entering the program had at least contemplated a self-management approach to pain at the outset. For these reasons, the changes that children – and, to a lesser extent, their parents – make in their willingness to adopt a self-management approach to pain over the course of treatment may be more valuable to the treatment outcomes than their level of willingness at the outset of treatment.

Study findings validate the clinical model of intensive interdisciplinary pediatric pain rehabilitation by illustrating that participation in such programs – which strongly emphasize adaptive coping, pain self-management, and functional restoration – does indeed correlate with increased willingness to self-manage pain. Based on the outcomes of this study, further development of clinical tools to aid in the adoption of self-management strategies and effect change in readiness to adopt such strategies could potentially benefit treatment outcomes. As Kerns and Rosenberg [14] recommend, there may be benefit to tailoring treatment techniques to individual's levels of readiness to adopt a pain self-management approach; such techniques would likely be most effective if they shifted in concert with changes in readiness over the course of treatment. However, several systematic reviews evaluating the effectiveness of interventions based on the transtheoretical model reveal inconsistencies in methodological quality, limited effectiveness of stage-of-change based interventions on behavior change, and the potential for the stage progression to inaccurately reflect the clinical process [1,16]. Thus, the potential benefits and limits to using willingness to self-manage pain to guide the treatment of children with chronic pain conditions must be carefully assessed through additional research before being adopted into clinical practice.

Several limitations are important to note. Although treatment with families in our pain rehabilitation program typically involves both mothers and fathers, the preponderance of parent data in this study was collected from mothers. As recent research indicates that mothers and fathers differ in the perceptions and responses to their child pain experience [7], obtaining data from both parents is recommended. The study relied entirely on self-report methods of data collection, introducing the possible influence of shared method variance. The number of comparisons analyzed in the study may have introduced risk of Type I error, although the majority of significant findings had strong P values (e.g. $P < .001$) that would withstand adjustment for multiple comparisons. Our follow up re-assessment period was briefer than has been reported in the adult literature (1-3 months versus 6 months in the similar study by Jensen and colleagues [11]). Regarding generalizability, our sample was overwhelmingly Caucasian and primarily comprised of patients diagnosed with Complex Regional Pain Syndrome and other neuropathic pain conditions. Readiness to adopt a self-management approach to pain should also be examined across diverse ethnic groups and in other chronic pain conditions (e.g., headache, abdominal, fibromyalgia). Finally, this is a naturalistic study of an existing treatment model. To fully understand potential causal

pathways that link increasing readiness for pain self-management and positive treatment outcomes, randomized controlled studies are needed to account for natural changes in attitudes toward pain self-management in the absence of intensive treatment participation.

As this is the first study to examine readiness to self-manage pain in children and adolescents as a potential mechanism of change and predictor of treatment response within the context of intensive interdisciplinary pain rehabilitation this study raises important implications for future research. Given that current psychological, physical, and occupational treatment approaches to chronic pain conditions emphasize self-management and ownership of the treatment process, using measures such as the pediatric PSOCQ during the course of treatment provides a simple but reliable means of assessing patient's openness and degree of engagement in this approach. However, self-report of willingness to self-manage pain should be compared to behavioral indicators of such willingness (beyond simply treatment dropout vs. completion), such as clinician ratings of treatment engagement throughout the treatment process or structured assessment of adherence to the home exercise regimen. In light of the finding that progress along the readiness to change continuum is associated with improved outcomes, future research should explore potential ways to promote this progression such as incorporating motivational interviewing [21] for patients and parents who report relatively lower levels of readiness for pain self-management prior to the onset of treatment. Other variables and processes that may play potentially important roles in the treatment process, such as self-efficacy and adherence to treatment recommendations, should be included in future studies of possible mediating influences on the path from treatment engagement to positive treatment outcomes [14]. Overall, this measure and these findings open up a tremendous number of possibilities for further research inquiry and clinical application.

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Summary statement

In an intensive pediatric pain rehabilitation program, increases in children's readiness to self-manage pain from pre- to post-treatment were associated with improved functioning and decreased emotional distress.

Figure 1.
Child readiness to self-manage pain over time

Figure 2.
Parent readiness to self-manage pain over time

Table 1

Means and Standard Deviations of outcome variables

Variable	n	Pre-Tx Range	Pre-Tx Mean (SD)	Post-Tx Range	Post-Tx Mean (SD)
Pain VAS score	156	0 – 10	6.3 (2.3)	0 – 10	4.9 (2.8)
Functional Disability Inventory	134	1 – 54	31.3 (10.2)	0 – 43	9.4 (8.3)
Children's Depression Inventory	132	35 – 94	55.3 (13.1)	34 – 93	37.4 (12.7)
Passive Coping (PRI)	134	0 – 3.8	1.2 (0.8)	0 – 3.3	0.6 (0.6)
Accommodative Coping (PRI)	134	0 – 4.0	2.0 (0.7)	0 – 4	2.3 (0.9)
Fear of Pain Questionnaire - Child	134	2 – 89	48.2 (18.5)	0 – 79	26.4 (17.8)
Fear of Pain Questionnaire – Parent	139	4 – 86	46.9 (17.7)	0 – 65	26.4 (15.6)

Table 2

Correlations between child and parent readiness to self-manage pain

Time point	PSOCQ Subscale	Child-Parent correlation (Pearson's R)
Pre-treatment	Precontemplation	0.24**
	Contemplation	0.16
	Action/Maintenance	0.37***
Post-treatment	Precontemplation	0.27**
	Contemplation	0.08
	Action/Maintenance	0.28***
Follow-Up	Precontemplation	0.28**
	Contemplation	0.27**
	Action/Maintenance	0.36***

**
P<.01***
P<.001.

Table 3
Change in readiness to self-manage pain from pre-treatment through 1-3-month follow-up

PSOCQ scale	Repeated measures ANOVA F (df = 2)	Pre-treatment M(SD)	Post-treatment M(SD)	Pre-treatment – post-treatment T Test	Follow-up M (SD)	Pre-treatment – Follow up T Test
Child Precontemplation	58.6 ***	3.32 (0.8)	2.36 (0.9)	11.12 ***	2.25 (0.9)	10.32 ***
Child Contemplation	12.4 ***	3.61 (0.7)	3.65 (0.6)	-0.71 (NS)	3.30 (0.8)	4.37 ***
Child Action-Maintenance	88.1 ***	3.24 (0.7)	4.24 (0.7)	-14.76 ***	4.08 (0.8)	-9.38 ***
Parent Precontemplation	62.6 ***	2.64 (0.7)	1.85 (0.6)	14.46 ***	1.86 (0.6)	9.70 ***
Parent Contemplation	26.5 ***	3.83 (0.6)	3.66 (0.5)	2.89 **	3.29 (0.6)	7.99 ***
Parent Action-Maintenance	76.7 ***	3.48 (0.6)	4.3 (0.4)	-15.54 ***	4.08 (0.5)	-9.94 ***

Note: N for Child Precontemplation = 144 at Pre-Tx, 132 at Post-Tx, 98 at Follow-up.

N for Child Contemplation = 144 at Pre-Tx, 132 at Post-Tx, 98 at Follow-up.

N for Child Action/Maintenance = 144 at Pre-Tx, 133 at Post-Tx, 98 at Follow-up.

N for Parent Precontemplation = 145 at Pre-Tx, 138 at Time Post-Tx, 95 at Follow-up.

N for Parent Contemplation = 146 at Pre-Tx, 136 at Post-Tx, 96 at Follow-up.

N for Parent Action/Maintenance = 146 at Pre-Tx, 139 at Post-Tx, 95 at Follow-up.

* p < .05

** p < .01

*** p < .001

Table 4

Regressions on child Action-Maintenance scores, with multiple outcomes

Variables	Beta	<i>t</i>	R ² Change
<i>Outcome: FDI (post-treatment)</i>			
<i>Step 1</i>			.20***
Pre-Treatment Action-Maintenance	-.2.88	-.25	3.08**
Pre-Treatment FDI	.30	.36	4.49***
<i>Step 2</i>			.03***
Pre-Treatment Action-Maintenance	-1.81	-.16	-1.78
Pre-Treatment FDI	.30	.36	4.52***
Post-Treatment Action-Maintenance	-2.46	-.21	-2.35*
<i>Outcome: CDI (post-treatment)</i>			
<i>Step 1</i>			.42***
Pre-Treatment Action-Maintenance	0.63	.63	8.25***
Pre-Treatment CDI	-.94	-.05	-0.67
<i>Step 2</i>			.04**
Pre-treatment Action-Maintenance	.60	.60	7.79***
Pre-treatment CDI	.06	.00	0.04
Post-treatment Action-Maintenance	-3.62	-.19	-2.46*
<i>Outcome: passive coping (post-treatment)</i>			
<i>Step 1</i>			.27***
Pre-treatment Action-Maintenance	.06	-.07	-0.82
Pre-treatment Passive coping	.36	.51	6.42***
<i>Step 2</i>			.10***
Pre-treatment Action-Maintenance	.06	.07	0.82
Pre-treatment Passive coping	.35	.51	6.81***
Post-treatment Action-Maintenance	-.30	-.34	-4.37***
<i>Outcome: accommodative coping (post-treatment)</i>			
<i>Step 1</i>			
Pre-treatment Action-Maintenance	.00	.00	-.01
Pre-treatment Accommodative coping	.79	.67	8.54***
<i>Step 2</i>			.05***
Pre-treatment Action-Maintenance	-.11	-.09	-1.1
Pre-treatment Accommodative coping	.77	.64	8.60***
Post-treatment Action-Maintenance	.32	.24	3.43***
<i>Outcome: Fear of pain (post-treatment)</i>			
<i>Step 1</i>			.20***
Pre-treatment Action-Maintenance	-3.64	.07	0.80
Pre-treatment Fear	.40	.40	5.45***
<i>Step 2</i>			.19***
Pre-treatment Action-Maintenance	1.59	.07	.80
Pre-treatment Fear	.39	.40	5.45***

Variables	Beta	<i>t</i>	R ² Change
Post-treatment Action-Maintenance	−12.78	−.49	−6.18***
<i>Outcome: Pain intensity (post-treatment)</i>			
Step 1			.61***
Pre-treatment Action-Maintenance	.79	.78	12.87***
Pre-treatment Pain score	−.15	−.04	−.57
Step 2			.00
Pre-treatment Action-Maintenance	.81	.06	12.70***
Pre-treatment Pain score	−.03	.29	−.10
Post-treatment Action-Maintenance	−.26	.30	−.88