Pain severity and pain catastrophizing predict functional disability in youth with inflammatory bowel disease☆

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Abstract

Background: Abdominal pain is commonly reported by youth with IBD. In a significant subset of youth, pain severity and pain catastrophizing (i.e., unhelpful thoughts related to the pain) may contribute to more negative outcomes and greater impairment in functioning. This study aimed to examine relationships of pain severity and pain catastrophizing with functional disability among a sample of youth with inflammatory bowel disease (IBD).

Methods: Seventy-five youth aged 11 to 18 years completed ratings of abdominal pain severity, pain catastrophizing, and functional disability using validated measures. Disease activity was rated by treating physicians.

Results: Over half of participants reported abdominal pain in the past two weeks, and pain was present among those with and without clinical disease activity. Nearly one-third of youth reported mild to moderate functional disability. After controlling for gender, pain severity accounted for 15% of the variance in patient functional disability. Moreover, pain catastrophizing contributed significant variance to the prediction of functional disability (approximately 7%) beyond the role of pain severity.

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1. Introduction

Abdominal pain is common among youth with inflammatory bowel disease (IBD). It may result from gastrointestinal tract inflammation due to disease activity, IBD-related procedures or surgical interventions, treatment side effects, or intestinal obstruction. Among youth with IBD participating in one recent study, over half reported abdominal pain, and of those reporting pain, the majority had no evidence of clinical disease activity. Functional abdominal pain (FAP) refers to recurrent pain resulting from visceral hypersensitivity or overactive nerves in the GI tract in the absence of any identifiable organic disease. In a study of 307 youth with Crohn’s disease (CD), 13% of those endorsing abdominal pain met criteria for FAP, providing evidence that FAP is a comorbid condition in a subset of youth with CD.

Regardless of whether or not an underlying organic explanation can be identified, abdominal pain adversely impacts physical functioning and health related quality of life (HRQoL) in affected youth. Several aspects of the abdominal pain experience may influence functioning including pain severity, pain duration, and one’s thoughts related to the pain experience. For example, regarding the duration of abdominal pain, youth with IBD who reported the presence of abdominal pain at two time points over a six-month period had significantly lower HRQoL than those reporting no abdominal pain at either time point. Moreover, the youth with IBD reporting abdominal pain at both time points were more likely to have clinical impairments in their HRQoL compared to either youth reporting abdominal pain at just one time point or youth without abdominal pain at either time point.

In addition to the role of abdominal pain severity and duration, thoughts related to the abdominal pain experience have also been associated with functional disability. Pain catastrophizing refers to a tendency to magnify or exaggerate the threat value or seriousness of pain sensations. In youth, catastrophizing can be thought of as extreme worry about the pain. Greater pain catastrophizing has been consistently associated with greater physical and psychosocial disability among patients with various pain conditions. However, the role of pain catastrophizing in predicting functional disability has yet to be explored in a pediatric IBD population.

Studying the role of the abdominal pain experience, including pain severity and pain catastrophizing, is important because a significant subset of youth with chronic pain experience a downward spiral of increasing functional disability, such as lack of participation in age appropriate activities (e.g., sports, social events), poor school attendance, and limited interaction with peers. For youth with IBD, examining relationships of both abdominal pain severity and catastrophizing with functional disability are important for several reasons. First, abdominal pain is an inherent part of IBD, and as such, youth with IBD are expected to experience at least intermittent abdominal pain throughout their lives. Moreover, because “curing” all episodes of abdominal pain is not a realistic goal in the context of IBD, identification of modifiable factors that may reduce the negative impact of abdominal pain on daily functioning is important. Cognitions related to abdominal pain have the potential to be modified and consequently, documenting their associations with functional disability is of value in maximizing adjustment in the context of pediatric IBD.

Thus, the current study explored the role of both pain severity and pain catastrophizing in relation to functional disability within a pediatric IBD sample. Specifically, this study aimed to: (1) describe rates of abdominal pain and functional disability among youth with IBD; and (2) to examine the role of both pain severity and pain catastrophizing in accounting for significant variance in functional disability. It was hypothesized that abdominal pain would be prevalent in this sample. Additionally, we expected that both pain severity and pain catastrophizing would be positively associated with functional disability in regression models, given findings supporting such associations within the pediatric chronic pain literature.

2. Materials & method

2.1. Study design

This study utilized baseline data from an adherence-promotion randomized clinical trial (RCT). Seventy-five participants were recruited from two Midwestern children’s hospitals. Patients meeting inclusion criteria were approached during scheduled outpatient gastroenterology clinic appointments by a research assistant. Interested families provided informed consent/assent and then completed a home assessment visit. During this visit, at least one parent/guardian completed a measure of demographic information. Youth completed measures of abdominal pain, pain catastrophizing, and functional disability. Medical records were reviewed for disease information.

Inclusion criteria were: (a) medically confirmed IBD diagnosis; (b) prescribed daily oral IBD maintenance medication; (c) age 11 to 18; and (d) at least one parent or guardian willing to participate. Inclusion criteria (b) and (c) related to the aims of the parent study which were to examine efficacy of an intervention to improve oral medication adherence among adolescents. Exclusion criteria were: (a) patient cognitive impairment that would preclude questionnaire completion; and (b) no English fluency.

2.2. Measures

2.2.1. Demographic information

Parents provided the following demographic information at baseline: youth age, gender, race/ethnicity, and family annual income.
2.2.2. Disease information

Medical record reviews were conducted to obtain information about type of IBD (i.e., Crohn’s disease, ulcerative colitis, or indeterminate colitis), length of IBD diagnosis, level of clinical disease activity at time of study enrollment, and medications prescribed for IBD treatment. Clinical disease activity was assessed with the Physician Global Assessment (PGA) scale, a single-item measure that was completed by the treating pediatric gastroenterologist at the time of the medical visit coinciding with study enrollment. The PGA is a validated global assessment of clinical disease activity. Patients are assigned a rating of no clinical disease activity/clinical remission (0), mild (1), moderate (2), or severe (3) clinical disease activity.

2.2.3. Pain catastrophizing

The Pain Catastrophizing Scale — Child Version (PCS-C) is a 13-item measure of thoughts and feelings children may experience when in pain. Youth rate their agreement with each statement using a 5-point Likert scale ranging from "not at all" (0) to "extremely" (4). The PCS-C yields a Total Score that can range from 0 to 52. Higher scores indicate greater pain catastrophizing. The PCS-C is reliable and valid in community and clinical samples (α = 0.90). In the current sample, internal consistency of the Total Score was excellent (α = 0.95).

2.2.4. Functional disability

The Functional Disability Inventory (FDI) is a well-validated 15-item self-report measure that assesses functional limitations of youth with a variety of pediatric conditions. Youth provide ratings on each item using a 5-point Likert scale ranging from "no trouble" (0) to "impossible" (4). Total Scores are computed by summing the ratings for each item. Higher scores indicate greater perceived functional disability. The FDI has high internal consistency in previous studies (α = 0.86 to 0.91) and in the current sample (α = 0.93).

2.2.5. Abdominal pain

The Abdominal Pain Index (API) is a well-validated, 5-item measure of youth intensity, frequency, and duration of abdominal pain during the past 2-weeks. Youth rate pain intensity using a 10-point scale ranging from "no pain" to "the most pain possible." Youth provide ratings on the frequency of pain using a 6-point scale ranging from "not at all" to "every day." The duration of pain episodes is rated using a 9-point scale (ranging from "a few minutes" to "all day"). Responses are standardized and summed to create the API Index Score, which is expressed as a measure of pain severity in Z score units. Internal consistency scores range from α = 0.78 to α = 0.93 in previous research. For this study, internal consistency was α = 0.88.

2.3. Data analysis plan

Preliminary analyses examined distributional properties of study variables. The PCS-C Total Score was significantly skewed, as were the API Index Score and FDI Total Score. A log linear transformation successfully normalized each variable’s distribution. Transformed variables were used in analyses; however, descriptive statistics are reported with non-transformed values for ease of interpretation. Descriptive analyses were conducted to evaluate Aim 1. Aim 2 examined the impact of pain catastrophizing (using the Total PCS-C Score as the dependent variable) on functional disability after controlling for pain severity using hierarchical regression analyses. In the regression model, the relative contribution of pain catastrophizing to functional disability was evaluated after controlling for pain severity. Additionally, because initial analyses demonstrated a significant association between gender and functional disability (r = 0.28, p = 0.02), gender was included as a covariate. See Table 1 for intercorrelations of study variables.

2.4. Ethical considerations

The Institutional Review Boards of participating institutions approved this study prior to any patient enrollment. All research team members completed ethical training in human subject research prior to becoming involved in the study. Interested families provided informed consent/assent at the time of enrollment. Parents provided written consent for their own participation as well as the minor child’s participation. Youth aged 18 provided written consent for their own participation. Youth of ages 11–17 provided written assent for their own participation. Those under age 14 signed a simplified assent form, while those of ages 14–17 provided assent by signing an assent line on the consent form.

3. Results

3.1. Descriptive analyses

See Table 1 for demographic and disease-related information about the current sample. Of the 132 families approached, 75 consented to participate (57%). Participants did not differ from nonparticipants in age (t (114) = 0.44, p = 0.661) or sex (Φ = 0.02, p = 0.794). Families were compensated for participation.

| Table 1 Summary of intercorrelations on gender, clinical disease activity, Abdominal Pain Index (API), Pain Catastrophizing Scale (PCS), and Functional Disability Inventory (FDI). |
|-----------------|---------|---------|---------|---------|---------|
| Variable        | 1       | 2       | 3       | 4       | 5       |
| 1. Gender       | –       | –0.11   | –       | –       | –       |
| 2. Clinical disease activity | –0.11   | –0.31** | 0.24*   | 0.34**  |         |
| 3. API          | –       | 0.31**  | –0.31** | 0.26**  | 0.40**  |
| 4. PCS-C        | –0.33** | 0.26*   | 0.31**  | –0.44** |         |
| 5. FDI          | 0.24*   | 0.40**  | 0.55**  | 0.44**  | –0.34** |

Note. API = Abdominal Pain Index; PCS-C = Pain Catastrophizing Scale for Children; FDI = Functional Disability Inventory. * p < 0.05. ** p < 0.01.
3.2. Frequency of pain, pain catastrophizing, and functional disability

The mean PCS-C Total Score was $M = 14.93$. Forty-nine participants (55%) reported abdominal pain during the past 2 weeks, with a mean pain intensity of 4.12 ($SD = 2.18$). Abdominal pain was present in 61% of youth with no evidence of clinical disease activity and among 75% of youth with evidence of clinical disease activity (See Fig. 1). Because pain was present among youth with and without clinical disease activity, all participants were included in subsequent analyses.

Fifty-five percent of the sample ($n = 41$) endorsed some functional disability. Based on previously established clinical cutoffs, $24\%$ of the total sample reported mild to moderate pain severity and pain catastrophizing predict functional disability in youth with IBD
levels of functional disability (an FDI total score range from 13 to 29). The remainder of the sample (92%) had FDI total scores below 13. None of the youth without abdominal pain scored above the clinical cutoff, whereas, 12% of youth with abdominal pain scored above the clinical cutoff.

3.3. Role of abdominal pain severity and pain catastrophizing in functional disability

Results of the regression analysis are presented in Table 3. In a hierarchical multiple regression analysis, abdominal pain severity accounted for 15% of the variance in FDI Total Scores, after controlling for gender. These findings were statistically significant, of medium effect size magnitude, and consistent with hypotheses. With regard to pain catastrophizing, PCS-C Total Scores accounted for an additional 7% of the variance in functional disability, beyond that accounted for by abdominal pain severity ($R^2 = 0.07$, $F(3, 71) = 8.14$, $p < 0.01$). These findings were consistent with prediction.

<table>
<thead>
<tr>
<th>Predictor</th>
<th>β</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1: Gender</td>
<td>−0.28</td>
<td>−3.05**</td>
<td>&lt;br&gt;Step 2: Abdominal pain severity</td>
</tr>
<tr>
<td>Step 3: Gender</td>
<td>−0.11</td>
<td>−1.34</td>
<td></td>
</tr>
<tr>
<td>Abdominal pain severity</td>
<td>0.79</td>
<td>4.14***</td>
<td></td>
</tr>
<tr>
<td>PCS-C Total Score</td>
<td>0.25</td>
<td>2.85**</td>
<td></td>
</tr>
</tbody>
</table>

Note: β = standardized partial regression coefficient. SE B = standard error of the unstandardized partial regression coefficient. β = standardized partial regression coefficient. PCS-C = Pain Catastrophizing Scale for Children. PCS-C Total Score Model: $R^2 = 0.11$ for Step 1; $R^2 = 0.33$ and $\Delta R^2 = 0.21$ for Step 2; $R^2 = 0.40$ and $\Delta R^2 = 0.07$.<br>---<br>Both B and β represent the unique effect of a given predictor variable on the dependent variable, partialling out the effect of other predictor variables in the model at the given step. B is interpreted in the original units of measurement (i.e., for every 1 point increase in abdominal pain, functional disability increases by 0.79 points, after partialling out the effects of gender and PCS-C scores).<br>---<br>β is expressed in standard deviation units (i.e., for every 1 standard deviation increase in abdominal pain, functional disability increases by 0.42 standard deviation units, after partialling out the effects of gender and PCS-C scores).<br>---<br>The t test examines whether B and β significantly differ from zero. A significant t statistic indicates that there is support for a given independent variable accounting for significant variance in functional disability scores, after partialling out the effects of other variables entered in that step.<br>---<br>$\Delta$ p < 0.01.

4. Discussion

The current findings suggest that functional disability is present among youth with IBD, with 8% of the sample reporting mild or moderate functional disability. Moreover, all youth experiencing functional disability endorsed abdominal pain during the last two weeks, suggesting that this is a group at particular risk for functional disability. Both the severity of abdominal pain endorsed and the presence of higher levels of catastrophic thinking each independently predicted functional disability in our sample. However, since catastrophizing effect sizes were relatively small, our findings suggest the importance of examining pain from a multidimensional perspective including, but not limited to, pain-related cognitions. Theoretical models suggest that while cognitions play an important role in predicting outcomes such as disability, other cognitive, emotional, and social constructs (e.g., family, school) also contribute to a youth’s experience with chronic pain.25-27

The current findings are informative in several respects. First, they serve to replicate findings related to associations of pain severity and catastrophizing with functional disability from past research with other pediatric illness groups including youth with chronic pain in a pediatric IBD sample.12,13 This is informative insofar as it suggests that these constructs are relevant to the understanding of functional disability even among youth whose abdominal pain may be related to an organic rather than functional etiology. Second, identification of pain catastrophizing as a correlate of functional disability is particularly important given that pain-related cognitions are potentially modifiable through cognitive behavioral interventions.28 Given the associations between catastrophizing and functional disability, the current findings suggest that reducing pain catastrophizing has the potential to decrease functional disability in this population.

4.1. Study limitations and future research directions

Although these findings contribute to the understanding of abdominal pain in youth with IBD, the present study is not without limitations. Several limitations regarding the sample characteristics limit generalizability of the current findings to the full population of youth with IBD. Specifically, the present sample had limited ethnic diversity, was primarily of middle to upper middle class socioeconomic background, and had low levels of disease activity. However, the ethnic distribution of participants in this sample was similar to that of the population of youth with IBD in the region,29 and the socioeconomic status is comparable to the typical population of families participating in IBD research.30,31 Additionally, the current analyses utilized data drawn from the baseline assessment of an adherence promotion RCT that required youth to have been prescribed an oral IBD maintenance medication. Thus, youth on other IBD treatment regimens (i.e., injection or infusion-based regimens) were excluded from this study, further limiting generalizability to those groups. In future research, a larger and more diverse sample would provide additional support for generalizability of these findings. In addition, inclusion of a sample with a greater
range of disease activity and functional disability may be of value. Our study relied on a brief assessment of clinical disease activity (i.e., the PGA), which may be less precise than measures of disease activity based on laboratory inflammatory markers or mucosal biopsy, and may have contributed to a greater proportion of patients being labeled as having no disease activity. That said, since the goal of IBD treatment is to induce remission of symptoms and promote optimal daily functioning, identification of youth with severe disease activity will require multisite studies that oversample for these characteristics. In addition, in such future studies it would be beneficial to include more precise measures of disease activity that incorporate inflammatory or mucosal disease markers. One possible way to do so would be to enroll patients at the time of endoscopy for a similar trial. Regarding the design, the current study employed a cross-sectional design, which did not allow for examination of changes in pain catastrophizing or functional disability over time. Future research which employs a longitudinal design would allow for more sophisticated modeling of trajectories of abdominal pain and pain catastrophizing over time and their impact on functional disability. Finally, the contribution of additional factors on functional disability of youth with IBD should also be considered for future research in this area given the modest amount of variance accounted for by pain severity and pain catastrophizing. Examining the role of parent and family factors such as parent catastrophizing on functional disability may be one productive avenue for future research.

4.2. Clinical implications

The current findings have several implications for clinical practice. Since abdominal pain is both inherently subjective and a characteristic symptom of IBD and its treatment, eliminating the presence of abdominal pain may be an unrealistic strategy for enhancing the functioning of affected youth. However, enhancing functioning via reduction of dysfunctional cognitions associated with abdominal pain is consistent with the cognitive behavioral model of pain. Thus, routine assessment of pain catastrophizing among youth with IBD may identify youth at risk for functional impairments. Given the brevity of the pain catastrophizing measure, the feasibility of implementation into clinical practice is high. For youth endorsing high levels of catastrophizing in the context of the their abdominal pain, referral to a behavioral health specialist for participation in interventions aimed at reducing levels of pain catastrophizing may be useful in decreasing functional disability.

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The authors have no financial relationships relevant to this article to disclose.

Conflict of interest statement

The authors have no conflicts of interest to disclose.

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