ORIGINAL ARTICLE

Child pain-related injustice appraisals mediate the relationship between just-world beliefs and pain-related functioning

(Running head): Child just-world beliefs and injustice appraisals

F. Daenen¹, J. McParland², F. Baert¹, M. M. Miller³, A. T. Hirsh³, T. Vervoort¹

¹ Department of Experimental-Clinical and Health Psychology, Ghent University, Belgium
² Department of Psychology, Glasgow Caledonian University, UK
³ Department of Psychology, Indiana University-Purdue University Indianapolis, US

* Corresponding author: Frederick Daenen, Department of Experimental-Clinical and Health Psychology, Ghent University, Henri Dunantlaan 2, B-9000 Ghent, Belgium. Tel: +32 (0)9 264 91 05 Fax: +32 (0)9 264 64 71. Electronic mail may be sent to Frederick.Daenen@Ugent.be

Disclosures: Funding for this research was provided through a grant awarded by Research Foundation Flanders to Tine Vervoort. The authors report no conflict of interest associated with this manuscript.

Significance: The present study adds to emerging literature on the adverse effects of child pain-related injustice appraisals in the context of pain, through showing that pain-related injustice appraisals are uniquely associated with pain-related functioning and mediate the relationship between just-world beliefs and pain-related functioning. These findings suggest that interventions may target pain-related injustice appraisals as a mechanism for change in children.
ABSTRACT

Background: Research among adult and pediatric samples suggests that pain-related injustice appraisals contribute to adverse pain-related functioning. However, a singular focus on pain-related injustice appraisals carries the risk of underestimating the role of broader concepts of justice. This study examined the unique roles of child pain-related injustice appraisals and just-world beliefs in understanding disability and physical, emotional, social, and academic functioning, as well as the mediating role of injustice appraisals in the relationship between just-world beliefs and functioning.

Methods: Participants comprised a school sample of 2174 children (Study 1) and a clinical sample of 146 pediatric chronic pain patients (Study 2) who completed the Injustice Experience Questionnaire (IEQ), Personal and General Belief in a Just World scales (JWB-P/G), Functional Disability Inventory (FDI), Pain Catastrophizing Scale for Children (PCS-C), and Pediatric Quality of Life Inventory (PEDSQL).

Results: For both samples, child pain-related injustice appraisals were associated with poorer functioning, after controlling for just-world beliefs, catastrophizing, pain intensity, age, and sex. In the school sample, injustice appraisals mediated the associations of both personal and general just-world beliefs with functioning. In the clinical sample, injustice appraisals mediated the association of personal, but not general, just-world beliefs with all functioning scales.

Conclusions: The current findings attest to the unique role of pain-related injustice appraisals in understanding child pain-related functioning and their explanatory value in understanding the relationship between fundamental just-world beliefs and child pain-related functioning.
**Introduction**

Pain-related injustice appraisals, conceptualized as cognitions comprising attributions of blame/unfairness and severity/irreparability of loss due to pain, contribute to adverse pain-related functioning in adults (Scott, Trost, Bernier, & Sullivan, 2013; Sullivan et al., 2008; Sullivan, Scott, & Trost, 2012; Trost et al., 2014) and children (Miller, Scott, Trost, & Hirsh, 2016). In a sample of youth with chronic pain, higher pain-related injustice appraisals contributed to increased pain intensity and disability, and poorer emotional, social, and academic functioning (Miller et al., 2016).

While this evidence highlights injustice appraisals about one’s own pain as a risk factor for poorer functioning, other research suggests that the ability to perceive justice, through *just-world beliefs*, can protect well-being among those with pain. The belief in a just world is conceptualized as an individual’s deeply ingrained view of the world as a just place in which everyone gets what they deserve. This belief enables individuals to view their environment as meaningful, predictable and controllable (Dalbert, 2009; Lerner, 1980) and includes *personal* (self-related) and *general* (world-related) beliefs. Being able to incorporate adverse experiences (e.g., bullying, illness, pain) into a broader justice belief system is considered an adaptive coping strategy in different contexts, including pain (Dalbert, 2001; Monden, Trost, Scott, Bogart, & Driver, 2016). Higher *personal* just-world beliefs, in particular, have been found to be associated with higher life satisfaction and lower depression (Lipkusa, Dalbert, & Siegler, 1996), as well as lower pain intensity, disability, and distress (McParland & Knussen, 2010). Higher *general* just-world beliefs were found to buffer the impact of disability on distress in adults with chronic pain (McParland & Knussen, 2010). Positive effects of holding just-world beliefs have also been observed in youth. *Personal* just-world beliefs have been associated with lower distress, depression and with higher life satisfaction in youth (Correia & Dalbert, 2007;
Correia & Vala, 2004; Donat, Peter, Dalbert, & Kamble, 2015; Kamble & Dalbert, 2012), although these relationships remain to be examined in the pediatric pain context.

To date, research on pain-related injustice appraisals and just-world beliefs is largely limited to adult (pain) samples. Research is needed to examine the role of both constructs within pediatric pain samples and disentangle their unique effects. Children may be especially sensitive to interventions targeting maladaptive pain appraisals. Indeed, the concept of fairness develops early (Fehr, Bernhard, & Rockenbach, 2008; Jose, 1990), and moral reasoning skills are linked to cognitive development (Enright et al., 1984; Güröglu, van den Bos, & Crone, 2009; Jacobs & Klaczynski, 2002; Kohlberg, 1976). Fairness is an especially salient concept in youth (Sutter, 2007; Murnighan & Saxon, 1998), with just-world beliefs at their highest in early adolescence (Oppenheimer, 2006). Furthermore, based on the conceptual relationship between just-world beliefs and injustice appraisals, it is important to not only examine the unique roles of both constructs, but also their interrelationship. As pain-related injustice appraisals may arise from lower levels of just-world beliefs, it is plausible that injustice appraisals mediate the previously identified relationships between lower just-world beliefs and worse functioning, and hence constitute a key (i.e., most important) target for intervention - yet, this remains to be assessed.

The aim of the present study was to 1) examine the unique roles of child pain-related injustice appraisals and (general and personal) just-world beliefs in understanding child pain-related functioning (i.e., disability and quality of life) and 2) examine whether pain-related injustice appraisals mediate the relationship between (general and personal) just-world beliefs and pain-related functioning. Relationships were examined in a sample of school children (Study 1) and a clinical, pediatric pain sample (Study 2) allowing conclusions relating to whether similar patterns manifest across samples.
STUDY 1

Method

Participants

The participants in this study were drawn from a sample which has previously been reported on by Baert & colleagues (2019). Research questions assessed and analyses performed in the current study are different from those reported before. A sample of 2,460 healthy school children was recruited from Flemish primary and secondary schools around Ghent, Belgium between March and May 2016. In total, 2460 children were contacted from 5 primary and 4 secondary schools. From the primary schools, classes ranging from the third until the sixth grade were considered; from the secondary schools, classes ranging from the first until the third grade were considered. 199 participants did not complete the questionnaires, because either parents or children refused to participate, or because of absence (e.g. due to illness). Of the 2261 responses, 87 questionnaires (3.8%) were deemed invalid due to missing or clearly inconsistent patterns of data. 2174 completed questionnaires remained eligible for analysis. The final sample was predominately female (51% girls) with a mean age of 12.06 years ($SD = 2.37$).

Measures

Pain-related Injustice Appraisals

Pain-related injustice appraisals were measured using the Injustice Experience Questionnaire (IEQ; Sullivan et al., 2008). The IEQ consists of 12 items describing pain-related injustice appraisals in the context of pain, e.g. “it all seems so unfair”. Children are asked to indicate how much they agree with each of the 12 statements on a 5-point Likert scale (ranging from 0, “never”, to 5, “all the time”). The IEQ has been developed for and mainly used in adult samples. Good reliability and validity for the English version of the IEQ has previously been demonstrated in a pediatric sample (Miller et al., 2016). In line with Miller & colleagues (2016), the instructions from the original questionnaire were slightly adjusted, as the original
instructions related to specific injury. Instead, participants were asked to focus on the effect of pain in daily life. A total score is calculated by summing the Likert ratings for all individual items, creating a total score ranging from 0 to 48 with higher scores indicating more pain-related injustice appraisals. Two subscales were found by the original authors and have generally been found in other studies (Rodero et al., 2012; Yakobov et al., 2014): a severity/irreparability of loss subscale (6 items, e.g. “Most people don’t understand how severe my condition is”) and a blame/unfairness subscale (6 items, e.g. “I am suffering because of someone else’s negligence”). However, these 2 subscales have been strongly correlated, with the original authors suggesting injustice can be conceived as a unitary construct (Sullivan et al., 2008), and subsequent research has mostly followed this unitary interpretation. In line with this, we also follow this unitary interpretation, supported by the high correlation between both subscales in the current sample ($r = .75, p < .01$) and by a principal components analysis indicating a unifactorial solution. For the present study, the IEQ was translated into Dutch using the forward-backward translation method. The Dutch version demonstrated adequate internal consistency in the present study ($\alpha = .86$).

**Just-World Beliefs: General & Personal**

Just-world beliefs were measured using both the Personal Belief in a Just World Scale (JWB-P; Dalbert, 1999) and the General Belief in a Just World Scale (JWB-G; Dalbert, Montada, & Schmitt, 1987). The former assesses how just and fair individuals believe events in their personal life to be via 7 items (e.g. “I believe that, by and large, I deserve what happens to me”, “I am usually treated fairly”). The latter similarly assesses how just and fair individuals believe events in the world to be via 6 items (e.g. “I believe that, by and large, people get what they deserve”, “I think basically the world is a just place”). For both scales, participants indicate agreement on a 6-point Likert scale. Ratings for all individual items of each scale are summed to create 2 separate total scores, ranging from 6 to 36 (general) and 7 to 42 (personal), with
higher scores indicating higher levels of the just-world belief. Good reliability and validity for these questionnaires have been demonstrated previously in adult pain (McParland, Knussen, Lawrie, & Brodie, 2013) and child samples (Correia & Dalbert, 2007; Correia & Dalbert, 2008; Dalbert & Stoeber, 2005; Dalbert & Stoeber, 2006; Donat et al., 2016; Kamble & Dalbert, 2012). For the present study, the JWB scale was translated to Dutch using the forward-backward translation method. Both the JWB-G scale and JWB-P scale demonstrated adequate internal consistency (α range [.77, .86]).

**Pain Catastrophizing**

Pain catastrophizing was measured using the Pain Catastrophizing Scale for Children (PCS-C; Crombez et al., 2003). Because pain catastrophizing has previously been found to be strongly correlated with pain-related injustice appraisals (Sullivan, Adams, Martel, Scott, & Wideman, 2011; Sullivan et al., 2012; Yakobov et al., 2014), we controlled for it in the current analyses. The PCS-C is a child-adjusted version of the Pain Catastrophizing Scale, consisting of 13 items describing how often participants experience rumination, magnification, and feelings of helplessness related to pain (e.g. “When I am in pain, I worry all the time about whether the pain will end”; Sullivan, Bishop, & Pivik, 1995). Participants are asked to indicate their agreement with all individual items on a 5-point Likert scale (ranging from 0, “not at all”, to 4, “extremely”). Likert ratings for all individuals items are summed, creating a total score that can range from 0 to 52 with higher scores indicating higher levels of pain catastrophizing thoughts. Good reliability and validity for the child-adjusted version of this questionnaire have previously been demonstrated in a Dutch-speaking sample (Crombez et al., 2003). The total score demonstrated good internal consistency in the present study (α = .87).
Average Pain Intensity

Average pain intensity over the past 6 months was measured using one item (i.e., “In the past 6 months, how severe was your pain on average?”) which was rated on a numeric scale, ranging from 0 (“no pain”) to 10 (“a lot of pain”).

Functional Disability

Functional disability was measured using the Functional Disability Inventory (FDI; Walker & Greene, 1991). The FDI consists of 15 items describing how difficult it is for an individual to perform certain daily activities (e.g. “Walking to the bathroom”). Participants are asked to indicate the difficulty they experience on a 5-point Likert scale (ranging from 0, “no trouble”, to 4, “impossible”). Total scores range from 0 to 60 with higher scores indicating higher levels of functional disability. The questionnaire is scored by summing the Likert ratings for all individual items. Higher scores reflect higher functional disability. Good reliability and validity for this questionnaire has been demonstrated previously among pediatric pain samples (Claar & Walker, 2006; Vervoort, Goubert, Eccleston, Bjittebier, & Crombez, 2006). The Dutch translation showed good internal consistency in the current study (α = .90).

Health-related Quality of Life

Health-related quality of life was measured by means of the Generic Core Scales of the Pediatric Quality of Life 4.0 (PEDSQL; Varni, Burwinkle, Limbers, & Szer, 2001). The PEDSQL consists of 23 items describing functioning across 4 different parts of life: physical functioning (8 items; e.g. “It is hard for me to run”), social functioning (5 items; e.g. “Other kids do not want to be my friend”), emotional functioning (5 items; e.g. “I feel afraid or scared”), and academic functioning (5 items; e.g. “I have trouble keeping up with my schoolwork”). Participants are asked to rate each individual item on a 5-point Likert scale (ranging from 0, “never”, to 4, “almost always”). The questionnaire is scored by reverse scoring all items to a 0-100 scale and calculating means for the total score and all subscales, ranging
from 0-100 with higher scores reflecting better health-related quality of life (total score) or better functioning within the specified domain (subscale scores). Good reliability and validity for this questionnaire have previously been demonstrated among a Dutch sample (Engelen, Haentjens, Detmar, Koopman, & Grootenhuis, 2009). The subscales showed adequate internal consistency in the present study (α range [.69, .83]).

**Procedure**

Participants were recruited through primary and secondary schools based around Ghent. In total, 29 schools were initially contacted through a letter and subsequently by telephone. Nine schools agreed to participate in the study. Children in the participating classes in these schools were given a letter with an invitation to participate in the study, as well as additional study information and a passive informed consent form. Afterwards, all consent forms from participating children were collected. Participating children completed the questionnaires at school. For their participation, participants were entered into a lottery procedure with a chance to win prizes such as film tickets. The study was approved by the Psychology and Educational Sciences Ethical Committee of Ghent University.

**Statistical analyses**

Normality assumptions were checked for all relevant variables before conducting the analyses. No violations were detected, with absolute values of skewness < 1.5 and values of kurtosis < 2. Pearson correlation analyses were conducted to assess bivariate relationships between injustice appraisals and (general and personal) just-world beliefs. A series of hierarchical regression analyses were conducted to investigate the unique role of pain-related injustice appraisals after controlling for (general and personal) just-world beliefs as well as child’s age, sex, pain intensity, and pain catastrophizing in explaining outcome variables (i.e. functional disability and 4 quality of life subscales). In step 1, the child’s age and sex (boys coded ‘0’, girls coded ‘1’) were entered. Step 2 included the child’s average pain intensity
during the past 6 months. In step 3, pain catastrophizing was added to control for its typically high correlation with injustice appraisals. In step 4, both personal and general just-world beliefs were added. Pain-related injustice appraisals were added to the model in step 5. Variance Inflation Factors (VIF) were inspected to check for multicollinearity; no problems were detected (all VIF values < 1.80). Following the regression analyses, mediation analyses were conducted to examine whether pain-related injustice appraisals mediate the relationship between (general and personal) just-world beliefs and child functional disability and 4 quality of life subdomains. To test this, a bootstrapping method was used with 5000 resamples, and weights were calculated for each path of the model, using the PROCESS macro for SPSS (Hayes, 2013; Preacher & Hayes, 2004). First, the total effect of just-world beliefs on the outcome measure (e.g., functional disability) was assigned weight c. This total effect consists of the direct effect of just-world beliefs on the outcome measure (weight c’) plus the indirect effect of just-world beliefs on the outcome measure through injustice appraisals (weight ab). This indirect effect ab is partialled out by calculating the effects of just-world beliefs on injustice appraisals (weight a) and injustice appraisals on the outcome measure (weight b). Following Zhao, Lynch, & Chen (2010), we consider the presence of an indirect effect as the only condition to establish mediation, even in the absence of total or direct effects. 

**Results**

**Descriptive statistics and correlation analyses**

Means, ranges, standard deviations (SDs) and correlations amongst variables are shown in Table 1. The general and personal just-world beliefs scores observed in the current sample were comparable to those previously reported amongst non-clinical child samples (see e.g. Correia & Dalbert, 2007; Donat et al., 2016; Kamble & Dalbert, 2012). No significant sex differences were found for the key variables of injustice appraisals, personal just-world beliefs, and general just-world beliefs (t range [-1.76, 0.32], ns). However, all three variables were
negatively correlated with age, indicating that older age is associated with lower injustice appraisals, and both lower *personal* and *general* just-world beliefs (*r* range [-.39, -.05], *ps* < .05).

Congruent with existing literature, correlation analyses indicated that higher injustice appraisals were significantly associated with higher pain catastrophizing, worse functional disability, and lower scores on all quality of life subscales. Higher injustice appraisals were associated with higher levels of *general* just-world beliefs and lower levels of *personal* just-world beliefs. Higher *personal* just-world beliefs were associated with more adaptive scores for functional disability and all quality of life subscales. Higher *general* just-world beliefs were associated with better emotional, social, and academic functioning.

- add Table 1 about here -

**Regression analyses**

The results of the hierarchical regression analyses are reported in Table 2. The analysis with child functional disability as dependent variable indicated that child sex and age accounted for 3% of the variance in step 1 (*F*(2,1889) = 28.51, *p* < .001). In step 2, average pain intensity accounted for an additional 14% of the variance (*F*(1,1888) = 320.44, *p* < .001). In step 3, pain catastrophizing accounted for a further 10% of the variance (*F*(1,1887) = 243.40, *p* < .001). Adding just-world beliefs and injustice appraisals to the analyses in step 4 and 5 respectively, accounted for additional variance yet it was relatively less than the other variables. Specifically, just-world beliefs accounted for an additional 1% of the variance (*F*(2,1885) = 15.15, *p* < .001) in step 4 and injustice appraisals a further 2% of the variance (*F*(1,1884) = 42.93, *p* < .001) in step 5. In the final model, lower age (β = -.06), higher average pain intensity (β = .10), higher pain catastrophizing (β = .26), lower *personal* just-world beliefs (β = -.08), and higher injustice appraisals (β = .17) were associated with higher functional disability (*ps* < .01).

- add Table 2 about here -
The analyses with each of the 4 quality of life subscales (i.e., physical, emotional, social, and academic functioning) as outcome variables revealed largely comparable findings across subscales. Specifically, for all 4 analyses, adding child sex and age in step 1 accounted for a modest but significant 1-4% of variance in scores on all quality of life subscales ($F_s \geq 11.25$, $p_s < .001$). In step 2, average pain intensity accounted for an additional 4-10% of variance in scores on all subscales ($F_s \geq 84.02$, $p_s < .001$). In step 3, pain catastrophizing also significantly accounted for an additional 3-10% variance in scores on all subscales ($F_s \geq 61.27$, $p_s < .001$). In step 4, adding personal and general just-world beliefs accounted for a modest but significant additional 2-5% of variance in scores on all subscales ($F_s \geq 26.58$, $p_s < .001$). Adding injustice appraisals in step 5 accounted for a similarly modest but significant additional 2-6% of variance in scores on all subscales ($F_s \geq 44.08$, $p_s < .001$).

In the final model, higher average pain intensity ($\beta$ range [-.17, -.05]), higher pain catastrophizing ($\beta$ range [-.13, -.06]), lower personal just-world beliefs ($\beta$ range [.12, .14]), and higher injustice appraisals ($\beta$ range [-.33, -.18]) were all associated with lower scores on all quality of life subscales ($p_s < .05$). Sex was associated with physical and emotional functioning ($\beta$ range [-.14, -.10], $p_s < .001$) such that boys reported better physical and emotional functioning compared to girls. Higher age was associated with lower emotional and academic functioning ($\beta$ range [-.14, -.08], $p_s < .001$). Higher general just-world beliefs were only associated with higher academic functioning ($\beta = .05$, $p < .05$).

**Mediation analyses**

Mediation analyses were conducted to examine the possible mediating role of injustice appraisals in the relationship between both personal and general just-world beliefs and all pain functioning measures. Total, direct and indirect effects can be found in Fig. 1 for personal just-world beliefs and in Fig. 2 for general just-world beliefs.

- add Figure 1 about here -
Higher personal just-world beliefs related to less functional disability \((c = -.32, SD = .03, p < .001)\) and less injustice appraisals \((a = -0.47, SD = 0.03, p < .001)\). Higher injustice appraisals related to more functional disability \((b = 0.44, SD = 0.02, p < .001)\). Analyses showed the indirect effect to be negative \((ab = -0.21, SD = 0.02)\) and significant as the bootstrapped confidence interval excluded zero \((95\% \text{ CI: [-0.25, -0.17]})\), indicating that higher injustice appraisals mediated the association between lower personal just-world beliefs and higher functional disability.

Similar findings were observed for all quality of life subscales as outcomes. Specifically, the indirect effects of personal just-world beliefs via injustice appraisals ranged between 0.22 and 0.43 \((ab; SD \text{ range [0.03, 0.04]})\) and were all significant \((95\% \text{ CIs: [0.17, 0.51]})\), such that higher injustice appraisals mediated the association between lower personal just-world beliefs and lower quality of life scores.

- add Figure 2 about here -

Analyses further demonstrated the mediating role of higher injustice appraisals in the relationship between lower general just-world beliefs and higher functional disability \((ab = 0.04, SD = 0.02; 95\% \text{ CI: [0.01, 0.08]})\), as well as lower quality of life scores \((ab \text{ range [-0.10, -0.06]}, SD \text{ range [0.02, 0.04]; 95\% CI: [-0.18, -0.01]})\).
STUDY 2

Method

Participants

Three hundred and nineteen pediatric chronic pain patients attending a Midwestern tertiary care interdisciplinary pediatric pain management clinic in the United States between January 2014 and March 2017 completed clinical measures during a clinic visit. Of the 319 patients, 146 completed the JWB questionnaires and thus were included in the current study. Previous investigations (Baert et al., 2019; Miller et al., 2016; Miller et al., 2018) have described the larger sample. Research questions assessed and analyses performed in the current study are different from those reported before. The current sample is predominately female (74%) with a mean age of 15.03 years ($SD = 2.15$). The most frequent pain diagnoses were musculoskeletal pain (49%), visceral pain (27%), and headache (25%). Diagnoses were derived from the patient’s chart, and are shown in Table 3.

- add Table 3 about here -

Measures

Parallel to Study 1, all participants completed questionnaires assessing pain-related injustice appraisals (IEQ), child pain catastrophizing (PCS-C), health-related quality of life (PEDSQL), functional disability (FDI), and personal and general just-world beliefs (JWB-P, JWB-G). Average pain intensity was assessed differently, as children were asked to rate, on a numerical rating scale ranging from 0 (“no pain at all”) to 10 (“most pain ever”), their average pain over the last week, rather than over the past 6 months. Internal consistency for all scales ranged from adequate to excellent ($\alpha$ range [.70, .93]). Similar to Study 1, the total IEQ score was employed given a high correlation between both subscales ($r = .81, p < .001$) and a principal components analysis supporting a unifactorial solution.

14
Procedure

Patients completed electronic versions of the questionnaires as part of a large battery of measures at the start and end of their appointment at the clinic. This data was retrospectively compiled as a dataset as part of a larger study protocol. Data were collected as part of their standard clinic visit. Children did not receive compensation for filling out measures. To guarantee compliance with Health Insurance Portability and Accountability Act (1996) and Protected Health Information standards, clinic personnel anonymized the dataset. Approval for this study was granted by the Indiana University Institutional Review Board.

Statistical analyses

As the aims for Study 2 are parallel to the aims of Study 1, similar statistical analyses were conducted. Normality assumptions were checked for all relevant variables before conducting the analyses. No violations were detected, with absolute values of skewness < 1.1 and values of kurtosis < 2. Variance Inflation Factors (VIF) were inspected to check for multicollinearity; no problems were detected (all VIF values < 2.80).

Results

Descriptive statistics and correlation analyses

Means, ranges, SDs and correlations between variables are shown in Table 4. Differences regarding levels of pain-related injustice appraisals and just-world beliefs between the healthy (Study 1) and clinical (Study 2) samples were assessed. The clinical sample demonstrated significantly higher levels of pain-related injustice appraisals ($t(2289) = 8.36, p < .001$). No significant difference between the 2 samples was found for general just-world belief scores. For personal just-world belief scores, the clinical sample scored significantly lower ($t(2284) = 9.68, p < .001$). No significant sex differences were found for the key variables of injustice appraisals, personal just-world beliefs, and general just-world beliefs ($t$ range [-1.10, 1.53], $ns$). There were also no significant correlations with child age ($r$ range [-.14, .16], $ns$).
Correlation analyses indicated that higher injustice appraisals were associated with higher pain catastrophizing and functional disability, and with lower scores on all quality of life subscales. Higher injustice appraisals were associated with lower levels of personal just-world beliefs, but, contrary to Study 1, were not associated with general just-world beliefs. Higher personal just-world beliefs were associated with better emotional, social, and academic functioning, but were not associated with functional disability or physical functioning. Higher general just-world beliefs were only associated with better academic functioning.

Regression analyses

The results of the hierarchical regression analyses are reported in Table 5. The analysis with child functional disability as dependent variable indicated that child sex and age accounted for 5% of the variance in step 1, however this model was not significant ($F(2,90) = 2.56$, ns). In step 2, average pain intensity accounted for an additional 31% of the variance ($F(1,89) = 42.40$, $p < .001$). In step 3, pain catastrophizing accounted for a further 5% of the variance ($F(1,88) = 7.40$, $p < .01$). In step 4, adding both just-world belief scales did not improve the model ($F(2,86) = 0.42$, ns). Finally, in step 5, injustice appraisals accounted for a further 7% of the variance ($F(1,85) = 12.23$, $p = .001$). In the final model, only higher average pain intensity ($\beta = .37$) and higher injustice appraisals ($\beta = .45$) were associated with higher functional disability scores ($ps < .01$).

The analyses with each of the 4 quality of life subscales (i.e., physical, emotional, social, and academic functioning) as outcome variables revealed largely comparable findings across subscales. Specifically, adding child sex and age in step 1 only accounted for 9% of variance in scores on physical functioning ($F(2,90) = 4.25$, $p < .05$). In step 2, average pain intensity accounted for additional variance in scores on physical, emotional, and academic functioning.
In step 3, pain catastrophizing accounted for additional variance in scores on all subscales ($\Delta R^2$ range [.12, .25], $F_s \geq 12.33, ps < .01$). In step 4, adding both just-world belief scales only accounted for additional variance in scores on academic functioning ($\Delta R^2 = .08, F(2,86) = 5.37, p < .01$). Finally in step 5, adding injustice appraisals accounted for additional variance in scores on all 4 quality of life subscales ($\Delta R^2$ range [.03, .12], $F_s \geq 4.97, ps < .05$).

In the final model, only higher injustice appraisals were associated with lower scores on all quality of life subscales ($\beta$ range [-.57, -.31], $ps < .05$). Higher average pain intensity was only associated with worse physical functioning ($\beta = -.34, p < .001$). Higher pain catastrophizing was only associated with worse emotional functioning ($\beta = -.27, p < .01$). Higher personal just-world beliefs were only associated with better academic functioning ($\beta = .22, p < .05$).

**Mediation analyses**

Mediation analyses were performed to examine the mediating role of injustice appraisals in the relationship between personal just-world beliefs and all pain functioning measures. Total, direct and indirect effects can be found in Fig. 3 for personal just-world beliefs and in Fig. 4 for general just-world beliefs.

- add Figure 3 about here -

Analyses demonstrated the mediating role of higher injustice appraisals in the relationship between lower personal just-world beliefs and higher functional disability ($ab = -0.36, SD = 0.13; 95\% \ CI: [-0.65, -0.13])$, as well as all lower quality of life scores ($ab$ range [0.71, 1.17], SD range [0.24, 0.33]; 95% CI: [0.30, 1.87]).

- add Figure 4 about here -

Further, analyses provided no evidence of injustice appraisals playing a mediating role between general just-world beliefs and all pain functioning measures, with the 95% confidence
intervals of all $ab$ estimates including zero ($ab$ range [-0.20, 0.75], $SD$ range [0.15, 0.42]; 95% CI: [-0.50, 1.52]).

The consistency of the results of the separate mediation models run for this smaller clinical sample give us confidence in their reliability: The results are consistent across the different models, with indirect effects observed for all models including personal just-world beliefs, and no indirect effects observed for any models including general just-world beliefs. Nevertheless, because multiple statistical tests were run on a relatively small sample, we also conducted sensitivity analyses in the clinical sample using more conservative 99% confidence intervals: The results were identical.
**Discussion**

The present study examined the role of child pain-related injustice appraisals and just-world beliefs in understanding pain-related functioning, as well as the mediating role of injustice appraisals in these relationships. Two questionnaire studies were conducted: one in a child school sample, and one in a clinical sample of children with chronic pain. The findings can be summarized as follows. First, across both samples, just-world beliefs, especially *personal* just-world beliefs, were negatively associated with pain-related functioning. Independent of these just-world beliefs, higher pain-related injustice appraisals were associated with worse pain functioning across samples. Second, mediation analyses indicated that the associations between lower just-world beliefs (especially *personal* just-world beliefs) and worse pain-related functioning were generally mediated by higher injustice appraisals. Only in the clinical sample did injustice appraisals not mediate the relationship between *general* just-world beliefs and pain functioning.

The present study advances the knowledge base on the link between pain-related injustice appraisals and children’s pain functioning. In particular, the effects of injustice appraisals on deleterious pain functioning were specifically pain-related, and not fully accounted for by the broader concept of just-world beliefs. This does not render broader just-world beliefs irrelevant in this context, as we found that school children who held greater just-world beliefs, especially those *personal* in nature, reported better functioning even after adding injustice appraisals to the analyses. This aligns with previous research showing that *personal* just-world beliefs are more strongly associated with well-being than are *general* beliefs (see e.g. Bartholomaeus & Strelan, 2019; McParland & Knussen, 2010; McParland, Knussen, Serpell, & Eccleston, 2014). Relevant in this context is that *general* just-world beliefs start to decrease at age 12, while *personal* beliefs do so at age 16 (Oppenheimer, 2006), emphasizing the importance of *personal* over *general* just-world beliefs for this particular age group. This
also perhaps explains our findings that *personal* just-world beliefs matter more for pain functioning, as our clinical sample was on average 3 years older than the school sample. However, even after accounting for these effects, higher pain-related injustice appraisals were still associated with worse pain-related functioning, hence attesting to their unique explanatory value. Furthermore, aligning with previous research in children (Miller et al., 2016) and adults (Sullivan et al., 2008; Sturgeon, Ziadni, Trost, Darnall, & Mackey, 2017; Yakobov et al., 2014), our findings indicated that despite strong correlations between injustice appraisals and pain catastrophizing (r range [.58, .72], ps < .01), injustice appraisals were still associated with pain-related functioning after controlling for pain-related catastrophizing, hence suggesting that pain-related injustice appraisals are distinct from catastrophic appraisals about pain and constitute an important target for intervention. Further, while the effects of injustice appraisals were stronger in the clinical sample, comparable findings were observed in the school sample. As such, the current findings not only support extending the relationship between injustice appraisals and pain-related functioning from adult samples to child samples, but also suggest these relationships largely generalize across healthy and clinical samples of children.

While causality cannot be confirmed, the current findings may imply that pain-related injustice appraisals are more prone to emerge among children with low levels of *personal* just-world beliefs. Specifically, lower *personal* just-world beliefs were associated with higher injustice appraisals across samples. Furthermore, findings indicate that higher injustice appraisals mediated the adverse associations of lower *personal* just-world beliefs with all pain-related functioning measures across both samples. In line with previous research (McParland et al., 2014), *general* just-world beliefs had minimal effect on pain-related functioning (the one exception being academic functioning in the school sample) and were only weakly associated with injustice appraisals in the school sample but not at all in the clinical sample. Accordingly, screening for *personal* just-world beliefs, rather than *general* just-world beliefs, may allow
identification of those most at risk for developing deleterious pain-related injustice appraisals. However, longitudinal research is needed to draw firm conclusions about whether lower personal just-world beliefs predispose to the development of higher injustice appraisals.

Beyond similarities observed across the healthy and clinical samples, some notable differences also emerged, with the clinical sample reporting significantly higher levels of injustice appraisals and lower levels of personal just-world beliefs, highlighting their clinical relevance. Such differences may arise from persistent pain and the associated losses that children and adolescents in the clinical sample have experienced. Indeed, evidence has demonstrated that chronic pain is associated with numerous adverse outcomes in children, such as worse quality of life, more days missed from school, and worse functional impairments (Huguet & Miro, 2008; Kashikar-Zuck, Goldschneider, Powers, Vaught, & Hershey, 2001). These findings also suggest that personal just-world beliefs are more malleable and influenced by life experiences than previously thought (Dalbert, 2001). Corroborating this notion, more recent studies have shown that personal just-world beliefs are impacted by significant life experiences (Corey, Troisi, & Nicksa, 2015), such as perceived victimization (Cubela Adoric & Kvartuc, 2007) and the quality of educational resources (Thomas & Napolitano, 2017). Longitudinal research is required to test how just-world beliefs and injustice appraisals evolve in the transition from acute to chronic pain, when the intensity of pain-related suffering may be expected to increase. Further, change in personal just-world beliefs may not only arise from personal pain experience, but may also be affected by familial experience related to child pain. Indeed, Dalbert & Radant (2004) found that nurture is important in strengthening personal just-world beliefs of young adolescents. Parental tension and stress, which often occurs in the context of chronic or persistent child pain (Campo et al., 2007; Eccleston, Crombez, Scotford, Clinch, & Connell, 2004), may affect this. Further, recent focus group research has demonstrated that mothers of children with chronic pain tend to frame the world as unfair; such
framing may affect the way parents talk to their children about pain and further shape children’s appraisal of pain (Baert et al., 2020).

While the present findings attest to the critical role of child pain-related injustice appraisals in understanding pain-related functioning, several avenues warrant further attention. In particular, further research is needed on the phenomenology of child injustice appraisals. The current measure, the Injustice Experience Questionnaire (Sullivan et al., 2008), operationalizes injustice from an adult perspective. Indeed, the IEQ was initially developed for adults suffering from a specific injury, and later extended to more general pain populations. However, in research with children, no items were adapted for a child population; at most, instructions were only slightly changed. At present, it is unclear whether the current item content captures pain-related injustice in its entirety as it emerges amongst children and adolescents. Further, while the current mediation findings suggest that interventions should target pain-related injustice appraisals, attention should also be given to the precise and diverse mechanisms whereby pain-related injustice appraisals, in turn, impact child pain-related functioning. Such mechanisms may operate at both the intrapersonal and interpersonal level. Research in the context of adult injustice appraisals regarding personal pain has identified anger and pain acceptance as key emotional or cognitive variables explaining the impact of pain-related injustice appraisals. For instance, Scott & colleagues (2013) found that anger mediated the impact of injustice appraisals on pain intensity and depressive symptoms, and Carriere & colleagues (2018) found that pain acceptance mediated the impact of injustice appraisals on pain intensity and opioid use. However, whether anger and acceptance play a similar role for children, and whether this varies across school and clinical samples, remains to be addressed. Parental protective responses to child pain, specifically, may constitute another route through which pain-related injustice appraisals impact functioning. Research has shown parental protective responses to be associated with higher child pain catastrophizing, and to lead to adverse child pain-related
functioning (Cunningham et al., 2014; Langer, Romano, Levy, Walker, & Whitehead, 2009). Following previous findings indicating pain catastrophizing is closely related to pain-related injustice appraisals, parental protective responses might also play a role in the association between child injustice appraisals and their pain-related functioning. Lastly, in the current study, fundamental views about the world (general or personal) were conceptualized as just-world beliefs and examined in conjunction with pain-related injustice appraisals allowing conclusions about their unique roles. However, other conceptualizations of non-pain-related (in)justice perceptions might potentially yield different results. The ‘Trait Injustice Experience Questionnaire’ (T-IEQ; Yakobov, Suso-Ribera, Vrinceanu, Adams, & Sullivan, 2019) is an adaptation of the (more situation-specific) IEQ and reflects general tendencies to appraise adverse events as unjust, in contrast to the JWB scales that reflect tendencies to see the world as just. Initial findings suggest trait perceived injustice to be more strongly associated with pain-related functioning than just-world beliefs (Yakobov et al., 2019). Further research is required to demonstrate the unique effects of pain-related injustice appraisals above and beyond a trait-like injustice measure or a trait-like justice measure.

Several limitations need to be considered. First, this study comprises cross-sectional data, which does not allow for causal inferences. Second, the two samples were collected in different countries (i.e. Belgium and United States), with cultural differences across samples as a possible consequence. Third, explained variance rates were modest, especially in the school sample which had a large sample size (N = 2174). While significant effects were established, caution must be exercised in their interpretation.

In spite of these limitations, the current findings demonstrate the unique role of child pain-related injustice appraisals above and beyond more fundamental just-world beliefs in understanding child pain-related functioning, as well as their explanatory value in understanding the relationship between fundamental just-world beliefs and child pain
functioning. Findings further attest to the potentially predisposing role of low (especially personal) just-world beliefs for the emergence of pain-related injustice appraisals. Further research is crucial to examine the phenomenology and mechanisms of child pain-related injustice appraisals.
Acknowledgements

We wish to thank Elke Decelle, Iris Audenaert, Marjan Vogelaers, Cynthia Van Gampelaere, Hannelore De Jonghe, Melanie Beeckman, and Elke Van Lierde for their contribution to the data collection of this study.

Author contributions

Frederick Daenen (corresponding author): data-analysis, writing of the manuscript.

Joanna McParland: thorough review and editing of the manuscript.

Fleur Baert: thorough review and editing of the manuscript.

Megan Miller: international collaboration, data collection, thorough review and editing of the manuscript.

Adam Hirsh: international collaboration, data collection, thorough review and editing of the manuscript.

Tine Vervoort: study design, data collection, thorough review and editing of the manuscript.
References


Legends

Figure 1: Mediation analysis paths for the *school* sample, with *personal* just-world beliefs (JWB-P) as independent variable, injustice appraisals as mediator (IEQ), and functional disability (FDI), physical functioning (PEDSQL-P), emotional functioning (PEDSQL-E), social functioning (PEDSQL-S), and academic functioning (PEDSQL-A) as dependent variables. Listed in order are weights, SDs, and either the *p* value or the 95% CI). *p < .05; **p < .01; ***p < .001.

Figure 2: Mediation analysis paths for the *school* sample, with *general* just-world beliefs (JWB-G) as independent variable, injustice appraisals as mediator (IEQ), and functional disability (FDI), physical functioning (PEDSQL-P), emotional functioning (PEDSQL-E), social functioning (PEDSQL-S), and academic functioning (PEDSQL-A) as dependent variables. Listed in order are weights, SDs, and either the *p* value or the 95% CI). *p < .05; **p < .01; ***p < .001.

Figure 3: Mediation analysis paths for the *clinical* sample, with *personal* just-world beliefs (JWB-P) as independent variable, injustice appraisals as mediator (IEQ), and functional disability (FDI), physical functioning (PEDSQL-P), emotional functioning (PEDSQL-E), social functioning (PEDSQL-S), and academic functioning (PEDSQL-A) as dependent variables. Listed in order are weights, SDs, and either the *p* value or the 95% CI). *p < .05; **p < .01; ***p < .001. a paths differ across outcomes due to differential sample sizes.

Figure 4: Mediation analysis paths for the *clinical* sample, with *general* just-world beliefs (JWB-G) as independent variable, injustice appraisals as mediator (IEQ), and functional disability (FDI), physical functioning (PEDSQL-P), emotional functioning (PEDSQL-E), social functioning (PEDSQL-S), and academic functioning (PEDSQL-A) as dependent
variables. Listed in order are weights, SDs, and either the \( p \) value or the 95\% CI). \( *p < .05; **p < .01; ***p < .001 \). a paths differ across outcomes due to differential sample sizes.