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More empathy for others, more hurt for oneself? Empathy for pain is related to poor mental health and negative emotion regulation

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Abstract

Background Empathy for pain refers to a simulation of pain experiences evoked when seeing others in pain. Empathy for pain (vicarious pain) responders make up 27% of the healthy population, and are divided into two subsets: Sensory/Localized responders who feel localized physical pain and Affective/General responders who experience diffuse emotional pain. Empathy for pain is linked to pro-social behavior but can increase mental health symptoms.

Methods Multivariate analysis of variance and latent variable mediation model were used to investigate the relationship between empathy for pain, mental health, and emotion regulation based on a university student dataset (mainly Caucasian) from 2020 to 2021.

Results (1) Responders express significantly higher anxiety and somatization than non-responders, with Sensory/Localized responders reporting the greatest somatic concerns; (2) Sensory/localized responders show significantly higher depression than non-responders; (3) Two responder groups don't differ from non-responders on most positive emotional regulation strategies, but use more negative strategies (self-blame, rumination, and catastrophizing). (4) negative emotional regulation fully mediates the link between empathy and mental health.

Conclusions These findings reveal a previously unrecognized link between empathy for pain and mental health, mediated by the increased use of negative emotion regulation strategies among responders. Our findings have particular implications for the mental health of empathic individuals or people who are often exposed to the pain of others (counselor or nurse, etc.).

Keywords Empathy for pain, Emotion regulation, Mental health, Depression, Anxiety

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Introduction

Oh, I have suffered with those that I saw suffer. --- William Shakespeare (The Tempest).

As an advanced social animal, we not only have emotional experiences ourselves, but may also have the capacity to share the experience of affective feeling states and corresponding emotional behavioral reactions of other people. This process is empathy, or at least, a component closely related to empathy [1]. Empathy for pain (vicarious pain) is a stereotypical expression of empathy: an internal simulation leads an individual to experience pain-like phenomena when seeing another person in pain [2]. This ability enables an individual to understand the pain of others, which, in turn, can increase prosocial behaviors [3] and also protect themselves from physical injury [4, 5]. Such consequences of empathic experience underpin a healthy, functioning society. Conversely, an apparent lack of empathy is more frequent among patients with psychiatric disorders [6], individuals with interpersonal difficulties [7], and those with anti-social behaviors [8]. Within hospitals or counseling centers, empathy for pain capability is often viewed as a highly desired quality [9], that promotes trust [10], patient satisfaction, and compliance [11] hence treatment adherence and eventual effectiveness [12]. However, while much is known about the positive side of empathy for pain, less attention has been paid to the negative effects of empathy for pain, for example, vulnerability to common mental health symptoms of anxiety and depression.

Vicarious pain responders refer to certain individuals who experience sensations of pain when observing others in pain, although most of the population do not feel overt pain when in the same situation [13, 14]. Approximately one-third of the general population report vicarious pain when observing a series of images or short film clips depicting noxious stimuli causing injury to others [15, 16]. Brain imaging suggests that pain responders may share both the emotional and sensory neural components of pain processing when observing another's pain [15]. Further investigations have classified vicarious pain responders into two groups: Sensory/Localized responders experience painful sensations localized on their own body to the observed site on another of painful stimulation or injury (S/L responders). Individuals in the Affective/General responder group report negative emotional/affective feelings of pain that are more diffuse and non-localized (A/G responders) [16]. The validity of partitioning vicarious pain responses into these groups is corroborated by group differences in brain imaging [17]. The two vicarious pain responder groups also appear to differ in their clinical and psychophysiological profiles from non-responders. Specifically, the A/G profile is linked to symptoms of Blood-Injection-Injury Phobia (a specific form of anxiety) and poor performance accuracy on tests of interoceptive sensitivity (for heartbeat detection). Individuals with an S/L profile, when observing pain in others, are reported to show increased heart-rate variability (HRV) which can be regarded as a healthy index of autonomic (parasympathetic) emotional regulation [18]. However, another study reported the observation that vicarious pain responders with high anxiety levels exhibit poorly regulated sympathetic arousal and attenuated inhibitory parasympathetic reactivity [19]. These studies indicate that vicarious pain responder groups diverge from non-responders, whether in physiology, brain response, or external emotional state.

There is increasing evidence suggesting that high empathy for pain is linked to worse mental health problems [20, 21]. For example, depression is a common psychological problem and an association between depression and empathy is gradually being uncovered. For instance, in a female sample of nurses, counselors, or social workers empathy scores were observed to show a significant positive correlation with depressive symptoms [22]. Similar results are found in different populations, including Jewish children [23], in-patient adolescents [24], and college students [25]. Additionally, meta-analysis also indicates that greater affective empathy may increase susceptibility to depression [26]. High empathy also appears to increase the propensity for other common mental health symptoms, including anxiety and personal distress [23, 27, 28]. Individuals with high empathy for pain have a higher risk for developing chronic pain [29, 30]. Accordingly, high empathy has been dubbed as a "risky strength" that amplifies vulnerability to psychological disorders [31]. Although the above work did not focus on empathy for pain, we hypothesize that the expression of vicarious pain responses is a risk factor for common mental health problems.

What mechanism might link higher empathy with vulnerability to mental health problems? Previous research finds that emotion regulation mediates the association between empathy and depression, and suggests that, in people who are strongly empathic, adaptive emotion regulation strategies offer the greatest protection against depression [32, 33]. Emotion regulation refers to the capacity to control, direct, and adjust emotional behaviors and responses to meet environmental demands [34]. Researchers have developed a cognitive emotion regulation model, which includes nine different options that can be categorized into positive and negative cognitive emotion regulation strategies [35]. Positive emotion regulation strategies refer to those that help individuals maintain their mental health levels, for example, "positive reappraisal" and "refocus on planning" while negative emotion regulation strategies refer to those that

are a risk factor for mental health (like "Self-blame" and "Rumination"). Four strategies have strong relationships with symptoms of depression and anxiety, which are self-blame, rumination, catastrophizing, and (inversely) positive reappraisal [36]. Self-blame and catastrophizing are reported more often by clinical patients than by individuals from non-clinical samples [37]. However, the above emotion regulation strategies are all intrapersonal processes. As the capacity to understand and even share the emotions of others, empathy is also likely to relate to interpersonal emotion regulation processes [38], through which individuals intentionally use social interaction to influence their own or others' emotions [39, 40]. Interpersonal emotion regulation processes include four aspects: enhancing positive affect, perspective taking, soothing, and social modeling [41]. With regards to empathy for pain, in particular, vicarious experiences engendering personal distress are theorized to arise as a consequence of poor emotion regulation due to weakened capacities (e.g. in executive functioning) and/or selection of ineffective regulatory strategies [42, 43].

The aim of this study is to determine the mental health status of vicarious pain responders and explore the relationship between empathy and mental health, specifically examining how emotion regulation strategies mediate this relationship. We hypothesize that individuals with high empathy for pain will report poorer mental health outcomes, characterized by increased symptoms of depression, anxiety, or somatization, and that these adverse effects are driven by their reliance on maladaptive emotion regulation strategies. To test these hypotheses, we analyzed questionnaire data from college students regarding empathy, mental health, and emotion regulation. This research is significant as it expands the understanding of empathy's dual role in promoting prosocial behavior while simultaneously posing risks for mental health, thereby informing interventions aimed at mitigating the psychological vulnerabilities of highly empathic individuals.

Method

Participants

Participants were recruited from 2020 to 2021 through the University of Sussex, School of Psychology recruitment system (Sona) and received 4 course credits or £4 for their participation. All the participants filled in informed consent forms prior to participation. The study's procedures were reviewed and approved by the Science and Technology Research Ethics Committee of Sussex University.

A total of 824 undergraduates took part in this study. Participants were mainly Caucasian and reported no psychiatric history. None of the subjects had a history of trauma or pain. Participants were divided into three groups based on the VPQ using two-step cluster analyses [16]. Details of this procedure are reported elsewhere [44]. The three groups consisted of a non-responder comparison group ($n = 615$, mean age = 19.79, $SD = 2.83$; females = 508), an Affective General (A/G) group ($n = 82$, mean age = 20.20, $SD = 2.51$; females = 73), and a Sensory-Localized (S/L) group ($n = 127$, mean age = 19.78, $SD = 2.77$; females = 109). The groups did not differ by age ($p = 0.449$) or sex ($p = 0.109$). A sensitivity analysis (G-Power 3.1, with power = 0.8, alpha = 0.05, test family = t tests, statistical test = means between two independent groups) showed that these sample sizes were adequate for detecting small effect sizes between non-responders and A/G group ($d \geq 0.32$) and S/L group ($d \geq 0.27$), and between the two responder groups ($d \geq 0.40$).

Materials

Vicarious pain questionnaire (VPQ)

The VPQ was designed to assess and categorize individuals' perceptions of vicarious pain [16]. The VPQ comprises 16 movies exhibiting actual injections and sports injuries in real-world settings. Subjects are required to indicate whether each movie caused them to experience pain thereafter. They will be prompted to respond to additional follow-up questions if they report pain, such as: (1) to answer whether they have pain and to rank their level of pain on a scale of 0 to 10; (2) to select the words that best express their agonizing emotions from a list of pain descriptors that characterize the sensory and emotional aspects of pain; and (3) to indicate whether their pain is localized or generalized. Three variables were calculated for the subsequent cluster analysis, including average pain response, localized-general, and sensory-affective [16]. The result of cluster analysis can be found in Supplementary Material Figure S1). Average pain response refers to the average pain level experienced by the participants, with a range from 0 to 10. Localized-general refers to the difference between the number of localized descriptors and the number of general descriptors, with a range from −10 to 10. Sensory-affective refers to the difference between the number of sensory descriptors and the number of affective descriptors, also with a range from −10 to 10. For further details see Botan et al. [45]. Previous studies have demonstrated that this scale exhibits good reliability [45, 46].

Emotional contagion scale (ECS)

The ECS was designed to assess one's susceptibility to feeling the emotions expressed by others [47]. The scale includes 15 items on a 5-point scale, ranging from 1 (Not at all) to 5 (Always). Example items include "I cry at sad movies". The ECS consists of five basic sub-emotions: love, happiness, sadness, anger, and fear. The total score is calculated as the sum of all item scores, with a higher

score indicating a stronger predisposition to emotional contagion [47]. Previous studies have shown that this scale demonstrates excellent reliability, with a Cronbach's alpha reliability coefficient of 0.95 [48].

Emotional empathic tendency scale (EETS)

The EETS was developed to assess the empathic emotional response, which is based on aggression and helping behavior [49]. The scale includes 33 items on a 9-point scale, ranging from −4 (Very Strong Disagreement) to 4 (Very Strong Agreement). Example items include "It makes me sad to see a lonely stranger in a group". The total score is derived by aggregating the ratings of all individual items, with higher scores indicating a greater tendency to have emotional empathy for other people. Mehrabian and Epstein (1972) demonstrated that this scale exhibits strong reliability and effectively assesses individuals' tendencies toward emotional empathy [49].

Depression, anxiety and stress scale – 21 items (DASS-21)

The DASS-21 was designed to measure the emotional states of depression, anxiety, and stress [50]. The scale includes 21 items on a 4-point scale, ranging from 0 (Did not apply to me at all) to 3 (Applied to me very much or most of the time). Example items include "I found it hard to wind down". The DASS-21 consists of 3 sub-scales (Depression, Anxiety, and Stress) and each sub-scale contains 7 items. The score for each subscale is calculated as the sum of the scores of its constituent items. Higher scores on each sub-scale indicate a greater tendency toward depression, anxiety, or stress-related issues. A previous study administered the DASS-21 to 1,815 Chinese college students and found internal consistency indices (Cronbach's alpha) of 0.83 for the Depression subscale, 0.80 for the Anxiety subscale, and 0.82 for the Stress subscale, with a total scale Cronbach's alpha of 0.92 [51]. Therefore, this scale exhibits good reliability.

Cognitive emotion regulation questionnaire (CERQ)

Cognitive emotion regulation refers to the cognitive processes individuals use to manage and respond to their emotional experiences, and the CERQ was designed to assess what cognitive coping strategies people use when experiencing something unpleasant [35]. The questionnaire includes 36 items on a 5-point scale, ranging from 1 (Almost never) to 5 (Almost always). Example items include "I feel that I am the one to blame for it". The CERQ consists of 9 sub-scales (self-blame, acceptance, rumination, positive refocusing, refocus on planning, positive reappraisal, putting into perspective, catastrophizing, other-blame), and each sub-scale contains 4 items. The total score is obtained by summing the scores of all individual items, while the score for each subscale is calculated as the sum of its constituent item scores. Higher subscale scores indicate that the corresponding strategy is employed more frequently by the individual. In previous studies, the CERQ has shown high internal consistency (Cronbach's alpha = 0.91), indicating robust internal consistency [52].

Interpersonal emotion regulation questionnaire (IERQ)

Interpersonal Emotion Regulation refers to managing one's emotional state through social interactions and the IERQ was designed to assess interpersonal emotion regulation strategies people use to regulate their own emotions through others [41]. The questionnaire includes 20 items on a 5-point scale, ranging from 1 (Not true for me at all) to 5 (Extremely true for me). Example items include "It makes me feel better to learn how others dealt with their emotions". The IERQ consists of four basic subemotions: enhancing positive affect, perspective taking, soothing, and social modeling. The score for each subscale is meticulously computed by aggregating the scores of its respective items, and the total score is calculated as the sum of all item scores. Previous studies have demonstrated that the IERQ and its subscales exhibit high internal consistency, with Cronbach's alpha values of 0.92 for the total scale, 0.78 for enhancing positive affect, 0.82 for perspective taking, 0.85 for soothing, and 0.82 for social modeling [53].

The anxiety sensitivity index (ASI-3)

The ASI-3 was designed to measure an individual's sensitivity to anxiety [54]. The index includes 18 items on a 5-point scale, ranging from 0 (Very little) to 4 (Very much). Example items include "It is important for me not to appear nervous". The ASI-3 consists of 3 sub-scales (social concerns, cognitive concerns, and somatic concerns), and each sub-scale contains 6 items. The score for each sub-scale is computed by summing its item scores, and the total score is the sum of all items. Higher total scores indicate a greater tendency to be anxious. The ASI-3 has been applied in clinical research, demonstrating robust reliability and validity, as evidenced by a reported Cronbach's alpha coefficient of 0.93 [55].

Patient health questionnaire-9 (PHQ-9)

The PHQ-9 was designed to measure patient's overall depression severity as well as track the improvement of specific symptoms with treatment [56]. The questionnaire includes 9 items on a 4-point scale, ranging from 0 (Not at all) to 3 (Nearly every day). Example items include "Little interest or pleasure in doing things". The total score is calculated as the sum of all item scores, with higher scores indicating a greater tendency to be influenced by depression. PHQ-9 score ≥ 10 had a sensitivity of 88% and a specificity of 88% for major depression. PHQ-9 scores of 5, 10, 15, and 20 represented mild,

moderate, moderately severe, and severe depression, respectively. Previous studies have shown that this scale demonstrates good reliability, with a Cronbach's alpha coefficient of 0.83 [57].

Patient health questionnaire-15 (PHQ-15)

The PHQ-15 is a somatic symptoms subscale derived from a self-administered version of the Primary Care Evaluation of Mental Disorders (PRIME-MD) diagnostic instrument for common mental disorders [58]. The questionnaire includes 15 items on a 3-point scale, ranging from 0 (Not bothered at all) to 2 (Bothered a lot). Example items include "Stomach pain". The total score is calculated by summing all item scores, ranging from 0 to 30. Scores of ≥ 5, ≥10, and ≥ 15 indicate mild, moderate, and severe levels of somatization, respectively. Prior research has indicated that this measurement tool exhibits good reliability, as evidenced by a Cronbach's alpha value of 0.78 [59].

Generalized anxiety disorder scale (GAD-7)

The GAD-7 was designed to measure or assess the severity of generalized anxiety disorder [60]. The scale includes 7 items on a 4-point scale, ranging from 0 (Not at all) to 3 (Nearly every day). Example items include "Feeling nervous, anxious or on edge". The overall score is determined by summing the scores of all items, where higher scores indicate a greater tendency to have greater levels of generalized anxiety. In prior research, the GAD-7 demonstrated high internal consistency with a Cronbach's alpha of 0.90 [61].

Body perception questionnaire - very short form (BPQ-VSF)

The BPQ is a 122-item self-report instrument measuring body awareness and autonomic reactivity [62]. We use the very short form (BPQ-VSF) in this study [63]. The scale uses a 5-point Likert scale, ranging from 1 (Never) to 5 (Always). We also choose two subscales from the full version of BPQ. One was "stress style I-behavioral responses to stress" (8 items, e.g. "When I am emotionally stressed because of a specific problem, I feel aimless"). The second subscale was "stress style II-physiological responses to stress" (4 items, e.g. "When I am emotionally stressed because of a specific problem, I feel my blood sugar drop"). The total score for each scale is calculated as the sum of the scores of all items it contains. Prior research has demonstrated that this measurement tool possesses strong reliability [64].

Procedure

All the questionnaires were administered via Qualtrics (https://www.qualtrics.com), an online software for coll ecting questionnaire data. The study took approximately 30 min. All questionnaires were completed in the same order (as outlined above).

Statistical analyses

Preliminary data checking was performed to test for the normality of all 10 questionnaires. We also calculated the means and standard deviations for each group (See Supplementary Material Table S1).

Factor analysis and MANOVAs

A factor analysis was conducted on 27 variables (the total score for each questionnaire and its subscales) using SPSS (Version 26.0). The aim was to generate latent variables (for interpretation) together with data reduction (fewer multiple comparisons). Prior to conducting principal factoring, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) and Bartlett's test of sphericity were used to determine the appropriateness of conducting a factor analysis [65]. The principal axis factoring method was selected for factor extraction. Results showed factor analysis was appropriate for this dataset (KMO = 0.888; p for Bartlett's test < 0.001). Analyses of multivariance (MANOVAs) were used to establish differences between groups on each questionnaire and for the latent variables from the result of factor analysis. Either Tukey HSD or Games-Howell post hoc t-tests for different sample sizes were run, depending on whether assumptions for equal variance or unequal variance were met.

Latent variable mediation model

In this analysis, we use the latent variable mediation model to examine the mediating roles of negative emotion regulation between empathy and mental health, and latent variables are chosen based on prior factor analysis. Specifically, the latent variable "empathy", "mental health", and "negative emotion regulation" is based on F3, F1, and F5. Mplus 8.3 was used to test the model. First, the direct effect of "empathy" on "mental health" was tested, and then the intermediate effect of "negative emotion regulation" between the two was tested by the Bootstrap method.

Transparency and openness

This study was not preregistered. Researchers can access data in the paper for research purposes by emailing ml587@sussex.ac.uk. We report how we determined our sample size, all data exclusions, all manipulations, and all measures in the study.

Results

Between group differences: factor analysis and MANOVAs

An initial analysis was run to obtain eigenvalues for each factor in the data. Twenty-four factors had eigenvalues over Kaiser's criterion of 1 and, in combination,

explained 97.62% of the variance. The scree plot was ambiguous and showed inflections that would justify retaining both five or six factors. Ultimately, we retained five factors because of the convergence of the scree plot and pattern matrix (see Table 1). Thus, we distinguished five underlying latent variables: Poor Mental Health (Factor 1), Positive Emotion Regulation (Factor 2), Interpersonal Emotions and Empathy (Factor 3), Personal Stress (Factor 4), and Negative Appraisals (Factor 5).

The five latent variables identified were included in a multivariate analysis of variance (MANOVA). Wilks's lambda multivariate test revealed a significant overall effect [$F(10,1634) = 8.154$, $p < 0.001$, $\eta_p^2 = 0.048$], and separate univariate tests showed significant differences between groups on Factor 1 Poor Mental Health [$F(2,821) = 30.821$, $p < 0.001$, $\eta_p^2 = 0.070$], Factor 3 Interpersonal Emotions and Empathy [$F(2,821) = 8.813$, $p < 0.001$, $\eta_p^2 = 0.021$]and Factor 5 Negative Appraisals [$F(2,821) = 5.900$, $p = 0.003$, $\eta_p^2 = 0.014$] but not on Factor 2 Positive Emotion Regulation [$F(2,821) = 1.152$, $p = 0.316$, $\eta_p^2 = 0.003$] or Factor 4 Personal Distress [$F(2,821) = 0.945$, $p = 0.389$, $\eta_p^2 = 0.002$]. Post hoc tests indicated that the S/L group scored higher than the non-responder group on Factor 1 ($p < 0.001$) and the A/G group scored higher than the non-responder group on Factor 1 ($p = 0.001$). There were no significant differences between the S/L and A/G groups on Factor 1. For Factor 3 Interpersonal Emotions and Empathy, post hoc tests indicated that the non-responder group scored higher than the A/G group ($p = 0.034$) and S/L group ($p = 0.001$), but there was no difference between S/L and A/G group ($p = 0.882$). As the factor loadings on this scale were negative, the interpretation is that (S/L and A/G) responders have higher interpersonal emotions and higher interpersonal emotion regulation. For Factor 5 Negative Appraisals, only the S/L group scored higher than non-responders ($p = 0.009$),

Table 1 Factor analysis results

	Rotated factor loadings					
Questionnaire	**Variable**	**F1: Poor Mental Health**	**F2: Positive Emotion Regulation**	**F3: Interpersonal Emotions and Empathy**	**F4: Personal Stress**	**F5: Negative Appraisals**
DASS-21	Depression	0.579				
	Anxiety	0.809				
	Stress	0.599				
PHQ-9	Total score	0.687				
GAD-7	Total score	0.757				
PHQ-15	Total score	0.755				
BPQ-VSF	Total score	0.631				
	Stress Style 1				−0.426	
	Stress Style 2	0.695				
CERQ	Self-blame				−0.480	
	Acceptance		0.565			
	Rumination				−0.568	
	Positive refocusing		0.501			
	Refocus on planning		0.697			
	Positive reappraisal		0.789			
	Putting into perspective		0.608			
	Catastrophizing					0.589
	Other blame					0.538
IERQ	Enhancing positive affect			−0.598		
	Perspective taking					
	Soothing			−0.617		
	Social modeling			−0.544		
ASI-3	Social concerns	0.434				
	Cognitive concerns	0.675				
	Somatic concerns	0.649				
ECS	Total score			−0.699		
EETS	Total score			−0.754		

Notes: The blank value means the coefficient is lower than 0.400. F1: Factor 1 (Poor Mental Health); F2: Factor 2 (Positive Emotion Regulation); F3: Factor 3 (Interpersonal Emotions and Empathy); F4: Factor 4 (Personal Stress); F5: Factor 5 (Negative Appraisals); DASS-21: Depression Anxiety Stress Scale-21 Items; PHQ-9: Patient Health Questionnaire-9; GAD-7: Generalized Anxiety Disorder-7; PHQ-15: Patient Health Questionnaire-15; BPQ-VSF: Body Perception Questionnaire - Very Short Form; CERQ: Cognitive Emotion Regulation Questionnaire; ASI-3: The Anxiety Sensitivity Index; IERQ: Interpersonal Emotion Regulation Questionnaire; EETS: Emotional Empathic Tendency Scale; ECS: Emotional Contagion Scale

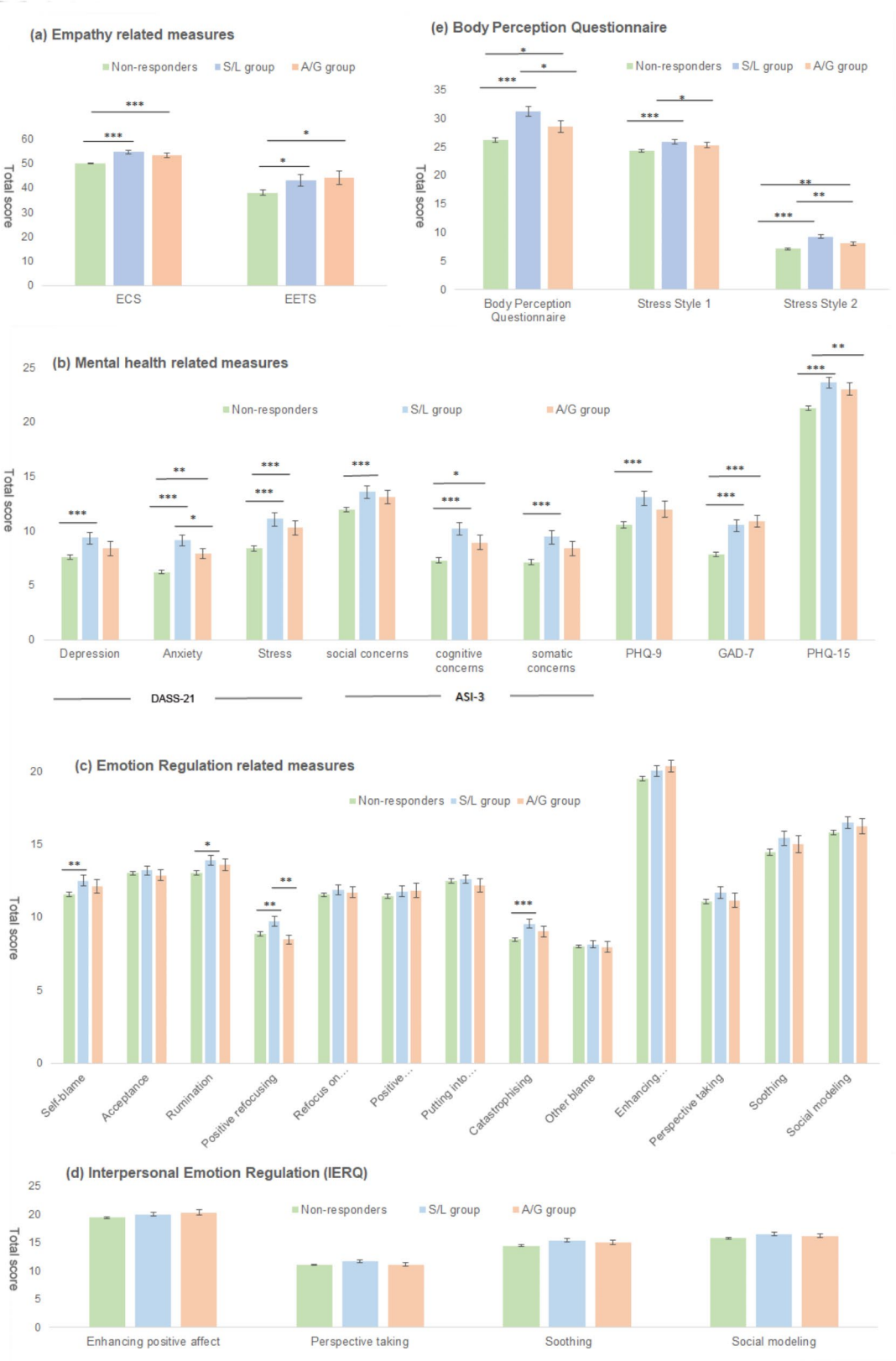

Fig. 1 (See legend on next page.)

(See figure on previous page.)

Fig. 1 (**a**) The group difference of empathy-related measures. (**b**) The group difference in mental health-related measures. (**c**) The group difference in cognitive emotion regulation related measures. (**d**) The group differences in interpersonal emotion regulation-related measures. (**e**) The group difference in body perception related measures. (*Notes*: Error bars indicate ± 1 SE. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; DASS-21: Depression Anxiety Stress Scale-21 Items; PHQ-9: Patient Health Questionnaire-9; GAD-7: Generalized Anxiety Disorder-7; PHQ-15: Patient Health Questionnaire-15; ASI-3: The Anxiety Sensitivity Index; EETS: Emotional Empathic Tendency Scale; ECS: Emotional Contagion Scale.)

and there was no difference between the A/G group and non-responders ($p = 0.688$), A/G group and S/L group ($p = 0.427$).

Between group differences: MANOVAs for all questionnaires

For empathy-related measures, there was a significant group difference between ECS [$F(2,821) = 19.077$, $p < 0.001$, $\eta_p^2 = 0.044$] and EETS [$F(2,821) = 3.670$, $p = 0.026$, $\eta_p^2 = 0.009$]. These effects were driven by both (S/L and A/G) responder groups being higher than the non-responder group (See Fig. 1 (a)). Thus, we found a relationship between empathy for pain (our initial group difference) and more general measures of affective empathy.

For mental health-related measures, there were significant group differences on PHQ-9 (depression) [$F(2,821) = 9.344$, $p < 0.001$, $\eta_p^2 = 0.022$], PHQ-15 (somatization) [$F(2,821) = 14.538$, $p < 0.001$, $\eta_p^2 = 0.034$], GAD-7 (anxiety) [$F(2,821) = 22.399$, $p < 0.001$, $\eta_p^2 = 0.052$], each subscale of ASI [social concerns: $F(2,821) = 6.218$, $p = 0.002$, $\eta_p^2 = 0.015$; cognitive concerns: $F(2,821) = 13.255$, $p < 0.001$, $\eta_p^2 = 0.031$; somatic concerns: $F(2,821) = 9.769$, $p < 0.001$, $\eta_p^2 = 0.023$], each subscale of DASS-21 [depression: $F(2,821) = 6.810$, $p = 0.001$, $\eta_p^2 = 0.016$; anxiety: $F(2,821) = 26.267$, $p < 0.001$, $\eta_p^2 = 0.060$; stress: $F(2,821) = 24.407$, $p < 0.001$, $\eta_p^2 = 0.056$]. These tended to be driven by both responder groups relative to non-responders, except for depression (DASS-1, PHQ-9) and ASI somatic concerns, which were driven more strongly by the S/L group. See Fig. 1 (b).

For cognitive emotion regulation measure, responder groups exhibited significantly higher levels of self-blame [$F(2,821) = 3.931$, $p = 0.020$, $\eta_p^2 = 0.009$], rumination [$F(2,821) = 3.741$, $p = 0.024$, $\eta_p^2 = 0.009$], positive refocusing [$F(2,821) = 4.562$, $p = 0.011$, $\eta_p^2 = 0.011$], and catastrophizing [$F(2,821) = 7.261$, $p = 0.001$, $\eta_p^2 = 0.017$] compared to non-responders. For details and post hoc tests, see Fig. 1 (c). For interpersonal emotion regulation measure, there is no significant difference between the three groups. For details and post hoc tests, see Fig. 1 (d).

For the body perception measures, responder groups exhibited significantly higher scores on BPQ [$F(2,821) = 17.592$, $p < 0.001$, $\eta_p^2 = 0.041$], stress style 1 [$F(2,821) = 8.496$, $p < 0.001$, $\eta_p^2 = 0.020$], and stress style 2 [$F(2,821) = 30.506$, $p < 0.001$, $\eta_p^2 = 0.069$] compared to non-responders. For details and post hoc tests, see Fig. 1 (e).

Latent variable mediation model

After controlling for age and gender, the direct predictive effect of empathy (F3) on mental health (F1) was firstly examined, and the structural equation model showed an acceptable fit with CFI = 0.82, TLI = 0.80, RMSEA = 0.10, 90%CI = [0.09, 0.11], and SRMR = 0.11 [66, 67]. The results indicated that empathy significantly influenced mental health ($\beta = 0.19$, $p < 0.001$). Secondly, a predictive model of empathy on mental health with negative emotion regulation (F5) as a mediating variable was constructed, and the model showed an acceptable fit with CFI = 0.88, TLI = 0.85, RMSEA = 0.09, 90%CI = [0.08, 0.09], and SRMR = 0.07 [66, 67]. The results (as shown in Fig. 2) indicated that empathy significantly positively predicted negative emotion regulation ($\beta = 0.13$, $p = 0.001$), negative emotion regulation significantly positively predicted F1 ($\beta = 0.40$, $p < 0.001$), and the direct effect of empathy on mental health was not significant ($\beta = 0.09$, $p = 0.06$). Negative emotion regulation played a complete mediating role between empathy and mental health, with a mediating effect of 0.05 and a 95%CI = [0.01, 0.09].

Discussion

The present study examined the links between empathy for pain, common mental health symptoms, and emotion regulation strategies. Specifically, we aimed to examine whether vicarious pain responders report more mental health problems, potentially as a consequence of using more negative emotion regulation strategies. Consistent with our hypotheses, we found that both groups of vicarious pain responders reported symptoms indicative of poorer mental health (depression, anxiety, and somatization) and they used significantly more negative emotion regulation strategies (self-blame, rumination, catastrophizing) than the non-responder comparison group. The structural equation model also indicates that negative emotional regulation fully mediates the link between empathy and mental health.

Mental health and empathy for pain

Our results indicated that heightened empathy for pain was linked to significantly poorer mental health, which is in line with previous work [18, 26–28, 68]. This is the

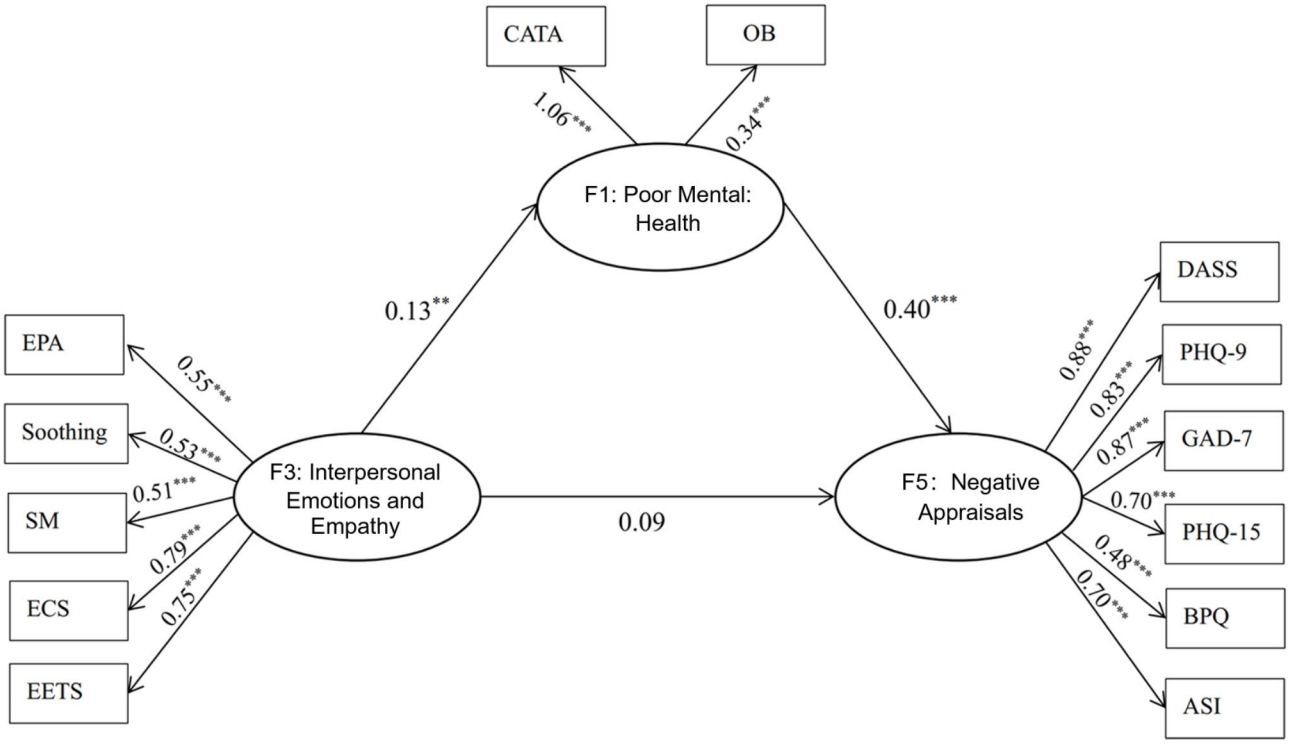

Fig. 2 Mediation effect model of negative emotion regulation on the association between empathy and mental health. (Notes: DASS: Depression Anxiety Stress Scale; PHQ-9: Patient Health Questionnaire-9; GAD-7: Generalized Anxiety Disorder-7; PHQ-15: Patient Health Questionnaire-15; BPQ: Body Perception Questionnaire; ASI: The Anxiety Sensitivity Index; EETS: Emotional Empathic Tendency Scale; ECS: Emotional Contagion Scale; CATA: Catastrophizing; OB: Other blame; EPA: Enhancing positive affect; SM: Social modeling; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$)

first time that this has been demonstrated and further dissected within the refined classification framework for vicarious pain put forward by Grice-Jackson and colleagues [16]. It is worthwhile emphasizing that all participants took the VPQ and mental health measures in separate sessions (with no indication that these assessments were linked), hence there was no low-level confound to our data such as common contextual priming of (different) responses.

In general, we found that the two vicarious pain responder groups were similar. There were some particular instances in which differences were found only for the S/L group (e.g., depression and stress on the DASS, social and somatic concerns on the ASI). It is possible that the S/L group is quantitatively more extreme and presents a different profile by virtue of having more 'realistic' pain experiences. However, it may be premature to endorse strongly this conclusion given that the A/G group is somewhat rarer (as we had less statistical ability to detect differences for that group). Post-hoc tests showed S/L and A/G groups did not differ significantly on measures of either mental health symptoms or emotion regulation. The exception to this was the Body Perception Questionnaire where the S/L group showed significantly higher scores relative to A/G in behavioral and physiological responses to stress.

Mental health includes our emotional, psychological, and social well-being [69]. It influences our thoughts, emotions, and behaviors. Additionally, it influences how we respond to stress, interact with others, and make decisions. In this study, we focus only on negative mental health symptoms, such as depression and anxiety. Although strongly associated with prosocial behavior [70], empathy for pain has also been implicated as a vulnerability factor for mental health issues, like depression [68], anxiety [71], and eating disorders [72]. The two main components of empathy are described as affective empathy, which refers to sensitivity to, and experience of other people's emotions, and cognitive empathy, which refers to adopting other people's viewpoints and comprehending their feelings [73, 74]. Typically, a positive association is inferred between affective empathy and poor mental health, while high cognitive empathy may protect against mental health symptoms [25, 27]. The poor level of the vicarious pain responders' mental health may emerge as a direct effect of habitually sharing the pain of others. We think of this process as spontaneous and bottom-up. Alternatively, there may be some intermediate variable linking mental health and empathy for pain. Maladaptive emotional regulation strategies may, in effect, be the bridge between these two sets of symptoms (see next section for details). For example, biological predispositions

to emotion regulation difficulties, together with adverse environmental factors, have been proposed to put highly empathic individuals at risk for the development of anxiety and depressive symptoms [31].

In high-pressure work environments, healthcare workers often neglect their own needs due to excessive empathy for others, which can lead to emotional exhaustion and burnout [75]. This phenomenon is particularly concerning in healthcare settings, where the demands of caregiving and the emotional toll of dealing with patients' suffering can overwhelm individuals. Self-compassion is a crucial concept in addressing this issue. It refers to treating oneself with the same kindness, care, and understanding as one would offer to a friend in times of difficulty [76]. Self-compassion involves acknowledging one's limitations, accepting emotional pain, and avoiding self-criticism [77, 78]. By establishing clear boundaries between oneself and others, healthcare professionals can prevent over-identification with their patients' suffering, thus protecting their own emotional well-being [79].

Emotion regulation and empathy for pain

Our study demonstrated no group differences for the positive emotion regulation factor. However, vicarious pain responders scored lower than individuals within the non-responder comparison group for the (positive) interpersonal emotions and empathy factor, and the S/L group scored higher than the non-responders for the negative appraisals factor. Our findings were partly in accordance with our hypotheses and previous research. Notably, we found that instead of the A/G group, the S/L group used more negative emotion regulation strategies. This was consistent with our mental health results. It is plausible that individuals in the S/L group experience more mental health issues because they use maladaptive emotional regulation strategies. However, the relationship may still be present among those in the A/G group, but we had less statistical ability to detect such an effect.

We also found that S/L responders used more maladaptive emotion regulation strategies like self-blame, rumination, and catastrophizing. Maladaptive emotion regulation has previously been associated with high empathy; however, our study is the first to identify specific types of strategies that are related to empathy for pain. Previous findings demonstrate that generalized guilt and shame mediate the relationship between affective empathy and depressive symptoms [24]. This observation is strengthened by our findings because self-blame is a component of self-directed emotions like guilt and shame [80]. No studies previously explored the relationship between Rumination and pain empathy. We propose that rumination is one cause of mental health problems in vicarious pain responders, not least since rumination is associated with higher depression levels [81]. A catastrophizing mindset is typically associated with depression, emotional distress, and maladaptation [82]. In pain catastrophizing, individuals show more complex and persistent pain behavior [83, 84], which will lead to the experience of more intense pain [82], reduced involvement in daily activities [85], and occupational disability [82, 86, 87]. Therefore, when S/L responders see the pain of others, if their own pain is catastrophized, it may initiate and exacerbate psychological problems.

Our conclusions have important implications for emotional health problems caused by high empathy. For example, people who work in physical and mental health services, in settings that include hospitals and psychology clinics, are often selected and expected to have more empathy [88]. In their roles, these people are chronically exposed to the suffering of others. Attention should be paid to their heightened vulnerability to mental health problems, mitigating strategies put in place and planned interventions should be made available. Our study provides relevant insights. For example, highly empathic individuals may be better helped by interventions that focus on minimizing the adoption of negative emotion regulation strategies, like self-blame, rumination, and catastrophizing, rather than blanket advice to use positive emotional regulation strategies like positive refocusing, refocus on planning, positive reappraisal.

Limitations and future directions

It is worth noting some limitations of the current study. Firstly, regarding the scope of mental health symptoms, our study focused on anxiety and depression as common mental health symptoms associated with high empathy. This narrow focus may have limited our understanding of the full spectrum of mental health issues related to empathy. For instance, eating disorders [89], bipolar disorder [90], obsessive-compulsive disorder (OCD) [91], and burnout [92] are also conditions that have been linked to strong empathy. By not including these broader mental health problems, we may have overlooked important insights into the multifaceted nature of empathy's impact on mental health. Future studies should explore these additional disorders to gain a more comprehensive understanding.

Secondly, the diversity of participants in our study was constrained to undergraduate psychology students. Research by Litten et al. (2020) indicates that students with higher levels of cognitive empathy are more likely to choose psychology over other disciplines [93]. This could have affected our data in terms of the reported levels of empathy and mental health symptoms and may restrict the generalizability of our findings to other populations. Future research should consider including participants from diverse disciplines to assess the broader applicability of the results. In addition, despite an equal sex ratio

within each VPQ group, the overall sample exhibited a significant imbalance, with a lower proportion of men and a higher proportion of women. Research has indicated that men and women may differ in their expression of empathy and emotion regulation strategies [94]. Women may be more likely to report higher levels of empathy, and this could have skewed our data [95]. In the future, a gender-balanced sample would have allowed us to better understand these differences. Furthermore, the majority of our participants were of white European ancestry. This lack of cultural and racial diversity may have limited our ability to draw conclusions about how empathy and mental health are perceived and experienced in different cultural contexts. Cultural differences in the expression and understanding of empathy have been documented, and these differences can significantly impact mental health. For example, in some cultures, collectivist values may lead to different expectations and experiences of empathy compared to individualistic cultures [96]. Future research should explore these cultural variations to provide a more inclusive and representative understanding of the relationships among empathy, emotion regulation, and mental health.

Thirdly, this study is cross-sectional design, which restricts the ability to draw causal conclusions. Since data was collected at a single point in time, it is not possible to establish cause-and-effect relationships between variables. Future studies with longitudinal designs would be necessary to explore potential causal links.

Lastly, although we considered using multigroup analysis to explore differences between groups, due to the unequal sample sizes across the groups, conducting a multigroup analysis could potentially lead to instability in the results [97]. Therefore, this method was not adopted in the current study. Future research could consider balancing the sample sizes across groups or using other appropriate analytical methods to further examine the applicability and robustness of the model across different populations.

Conclusion

In conclusion, our findings suggest that the vicarious pain responders have worse mental health levels and use more negative strategies to regulate and manage their emotions. In addition, negative emotional regulation fully mediates the link between empathy and mental health. We argue that this reflects a mechanism through which excessive empathy may harm us and increase our vulnerability to emotional distress. To combat this vulnerability, we recommend reducing the use of negative emotional regulation strategies, such as self-blame, catastrophizing, and rumination Our findings have particular implications for the mental health of empathic individuals, such as people who are often exposed to the pain of others (counselor or nurse, etc.).

One important societal application of these findings lies in how to manage the mental health of caregivers and professionals who frequently encounter others' suffering. By training adaptive coping mechanisms, reducing self-blame, rumination, and catastrophizing, and promoting self-compassion, it may help reduce the risk of burnout and emotional exhaustion. For example, healthcare systems could integrate mental health support programs focused on enhancing emotional resilience, enabling staff to maintain both empathy and high performance while preserving their personal well-being. Additionally, this research could inform policy-making in professional environments that expect high levels of empathy, emphasizing the need for mental health resources and the establishment of personal boundaries to alleviate the emotional burden of caregiving work.

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

Author contributions

Conceptualization: M. Li, J. Ward and H. Critchley; Methodology: M. Li, Q.Yang, Q. Jia, and B. Liu; Formal Analysis: M. Li and B. Liu; Visualization: M. Li, Y. Feng; and T.Yuan Writing – Original Draft Preparation: M. Li; Writing – Review & Editing: J. Ward, H. Critchley and Qun Yang.

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Data availability

Dataset is available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The study's procedures were reviewed and approved by the Science and Technology Research Ethics Committee of Sussex University and all subjects completed the informed consent form. The present study adhered to the ethical standards outlined in the Declaration of Helsinki.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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