



The paradox of empathy for pain: Personality, adversity, and affective resonance in psychiatry

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ABSTRACT

Empathy for pain (EfP) refers to the capacity to experience and understand others' pain and represents a fundamental process for psychosocial functioning. Psychiatric literature on EfP remains at times paradoxical, reflecting both intra- and interindividual variability. Notably, EfP appears either diminished or heightened across various psychiatric conditions. This scoping review aims to synthesize current findings to identify unifying patterns, focusing specifically on the influence of early life adversity (ELA), adulthood stressors, and personality traits on EfP processes. The literature was reviewed across two core domains: the neurobiological mechanisms underlying EfP and psychiatric diagnoses characterized by empathic dysfunction. Therapeutic implications are also discussed.

EfP consistently recruits the anterior insula and anterior cingulate cortex. Exposure to stressors results in differential patterns of activation in this core network, depending on the nature and severity of the experienced stress. Severe ELA heightens sensitivity to negative emotional cues and disrupts the balance between emotional and cognitive components of empathy, while moderate ELA induces a global decrease in both. Stressors encountered in adulthood tend to blunt empathic responses overall. Personality traits and disorders show specific EfP patterns: individuals with borderline personality disorder tend to display heightened emotional responses to others' pain, while those with psychopathic traits exhibit reduced emotional signal processing. Mentalization-based treatment has shown promising results in improving empathy deficits in personality disorders. Other approaches, such as mindfulness-based interventions and behavioral empathy training, may also support empathic functioning but remain under-investigated.

Introduction

Empathy for Pain (EfP) can be defined as the ability to perceive, resonate with, and understand another individual's experience of physical pain without actual tissue damage.¹ This construct shows

marked variability, with empathic responses to others' pain being either heightened or blunted across individuals² and within the same individual^{3,4} over time, and influenced by contextual^{3,5} and developmental^{3,4,6} factors. This paradoxical phenomenon arises from internal inconsistencies in neural activation patterns within core circuits

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subserving vicarious pain processing⁷ and dysregulated interactions among the affective, cognitive, and motivational subcomponents of empathic response.^{8,9}

Emotional empathy refers to affective sharing that allows individual's emotional responsiveness to another's experience of distress or pain. Cognitive empathy involves more elaborate secondary processes that enable identifying and understanding other's feelings and mental states (i.e., mentalizing).¹⁰ The third component of empathy is empathic motivation, defined as the motivational drive that governs engagement in empathic behavior, including the desire to alleviate others' distress, while balancing associated cognitive costs.⁸ EfP relies on the activation of core neural circuits implicated in both empathy^{7,11,12} and the processing of pain itself,^{7,11,13} as an unpleasant sensory and emotional experience.¹⁴ Indeed, EfP recruits somatomotor and emotional resonance pathways, activating the observer's internal representations of pain and enabling empathic responses.^{1,7,11,13}

Empathic processes are shaped by both intra- and inter-individual factors (psychological and social), including relational closeness,⁵ negative emotions,³ and dispositional empathy.^{3,4,6} For instance, conspecific mice exposed to pain simultaneously show greater hyperalgesia than foreign mice under the same conditions, after controlling for imitation.⁵ In highly empathic humans, placebo analgesia reduces the perception of other's pain, mirroring personal pain perception.⁴ An fMRI study also showed that inducing negative emotions before an EfP task reduced neural empathy response, particularly in individuals with lower trait empathy.³ Similarly, electrophysiological data suggest that individuals with higher dispositional empathy exhibit an increased motor inhibition in the muscle region matching the site of observed pain,¹⁵ reflecting an empathic defensive reflex.⁶ These findings support the idea that disruptions in EfP may result either from passive deficits, such as weakened automatic resonance, or from active deficits, involving impaired regulation or understanding of others' mental states.¹⁶

Although various psychiatric and neurodevelopmental disorders involve disruptions in empathy and interpersonal functioning, EfP remains an underexplored domain within psychopathology research, with findings to date being inconsistent.² For instance, while borderline personality disorder (BPD) was associated with heightened affective sharing during EfP tasks,^{17,18} psychopathic traits displayed overall reduced empathic response to other's pain.¹⁹ Contradictory results have also been reported within the same diagnostic category, as in major depressive disorder (MDD) where both reduced and intact EfP were found compared to controls in two different fMRI studies.^{20,21} The EfP dysfunctions contribute to internalizing and externalizing symptomatology.²² Heightened affective resonance to other's suffering induces distress, thereby potentiating anxiety-depressive symptoms and emotional dysregulation, whereas blunted affective sharing reinforces social withdrawal and interpersonal disengagement.^{22,23} By increasing the cognitive cost of empathic responses, both hypo- and hyper-reactivity to others' pain contribute to psychosocial impairment.^{8,22,23} Beyond disorder-specific profiles, this bidirectional pattern in EfP may be shaped by dispositional,²⁴ developmental,²⁵ and contextual factors,²⁶ consistent with a diathesis–stress framework.²⁷

Among these factors, early life adversity (ELA)—defined as exposure to traumatic or stressful events during childhood—affects the development of empathic abilities, particularly through primary processes of affective sharing (passive deficits).^{28,29} Neuroimaging studies have shown that children exposed to chronic adversity exhibit atypical engagement of empathy-related brain regions during affective tasks.^{25,30} In adults, higher levels of ELA have been linked to lower empathic concern,³¹ which refers to the tendency to care about others' suffering and to feel compassion.³² When stressful events occur during adulthood (proximal stressors), their impact appears less pervasive but can still influence the modulation of empathic responses.³³ For instance, acute psychosocial stress has been shown to increase emotional empathy accuracy in healthy young men³⁴ while in women with BPD, similar stress

exposure significantly reduced emotional empathy compared to controls.³⁵ To date, the impact of trauma and stressful events has received less attention in the literature specifically addressing EfP.

This scoping review aims to synthesize current evidence on EfP by integrating neurobiological mechanisms, the impact of early and proximal adversity, and personality-related vulnerabilities. We specifically seek to explain the paradoxical patterns of EfP across psychiatric conditions within a dimensional and developmental framework.

Methods

Given the sparse, heterogeneous, and conceptually fragmented literature, a scoping review approach was deemed appropriate to map existing evidence and identify key themes rather than to provide effect estimates directly generalizable to specific clinical populations. We searched PubMed and Web of Science databases for studies addressing EfP. Studies focusing on empathy more broadly were also considered due to their conceptual proximity to EfP and their relevance for contextualizing and interpreting EfP-related findings. The search strategy combined the terms 'pain' AND 'empathy' with 'personality', 'stress', 'life event', 'trauma', 'abuse', 'neglect', and 'maltreatment'. For the second aim—describing EfP in psychiatric disorders—additional terms were included. Detailed search procedures are provided in the Supplementary Materials.

Both review articles and original studies were included to ensure broad coverage. When review articles were selected, their reference lists were cross-checked against primary studies to avoid duplication. Studies were eligible if they assessed EfP, defined broadly as the affective, cognitive, or neurobiological response to observing or representing another individual's pain. No restrictions were imposed on the type of EfP measurement.

Consistent with scoping review methodology, records were not subjected to exhaustive or fully systematic screening. Instead, an aim-driven and iterative selection process was applied, involving targeted filtering and review of titles and abstracts guided by the conceptual focus of each aim. To ensure comprehensive coverage of the field, additional relevant sources were identified through complementary, non-systematic strategies, including screening reference lists of key publications and expert recommendations. A PRISMA-style flow diagram summarizes the identification, deduplication, and aim-driven selection process.

Results

The first section examines individual variations in EfP related to stressors and personality. While neural correlates of EfP are well-studied (seven meta-analyses), the impact of stressors and personality on EfP is less explored (seven original studies), though results are promising. The second part of this section explores EfP in psychiatric disorders and synthesizes data from comparative studies between general and clinical populations (twenty-three original studies and one systematic review), highlighting differences in EfP profiles according to disorders and promoting the further development of interventional studies.

To facilitate consistency and comparability across findings, we followed a structured approach. First, we prioritized developmental progression, presenting child and adolescent studies before those involving adult samples. Second, we applied an evidence hierarchy, discussing literature reviews prior to original studies. Finally, we followed a methodological hierarchy, presenting descriptive and behavioral studies first, followed by neuroimaging (fMRI, EMG), genetic studies, and, where available, clinical trials.

Basic features of EfP

Neural bases

Emotional empathy involves the anterior cingulate cortex (ACC),

anterior insula (AI), inferior frontal and inferior parietal gyri while cognitive empathy involves the ventromedial and dorsomedial prefrontal cortex.³⁶ Selective activity in the ACC, medial and anterior insula and the temporoparietal junction bilaterally (extending to the posterior superior temporal sulcus, referred to as the TPJ/pSTS) is key for EfP.^{7,37–39} These areas are also linked to direct pain,⁴⁰ confirming a core network, which includes the bilateral AI cortex and medial/ACC, for pain and EfP.⁷ Furthermore, the somatosensory cortex and visceral signals (e.g., cardiac rhythm) in conjunction with the AI are involved in bottom-up processes that underpin interoceptive processing of both self-experienced and vicarious pain.^{7,41} These networks are crucial to "feel" others' pain, whereas top-down circuits—including the ACC, prefrontal areas, and precuneus—support higher-order evaluation, thereby mediating self-other distinction.⁷

Table 1 shows summaries of meta-analytic studies. These meta-analyses, assessed according to the AMSTAR-2 criteria established by Shea et al., (2017), met an average of 8 out of 16 items (range: 6–12), demonstrating moderate methodological quality, with strengths in literature search and statistical methods but requiring improvement in risk of bias assessments⁴² (See Supplementary Materials).

Shared neural correlates underpin resonance with others' pain and highlight the central role of emotional processes in EfP. Meta-analytic evidence consistently identifies the AI and ACC as core components of the EfP network, supporting affective sharing and integrative processing of others' pain. Importantly, this conclusion is primarily based on methodologically robust meta-analyses. For example, Gu et al. (2012) reported convergent results across explicit and implicit tasks, identifying the AI as critical for affective state processing and the ACC as

Table 1
Meta-analyses on neural correlates of empathy for pain (EfP).

	Type of studies (n)	Time range	Sample	Main objective regarding EfP	Empathy construct	Main inclusion/exclusion criteria	Paradigms/Conditions	Stimuli	Main results	AMSTAR-2 criteria
Lamm et al., 2011⁷	Image-based (9), CBMA (32)	Until July 2010	HP	Identify neural networks	Unpleasant affect, sympathy, or pain perception	Empathy for physical pain only, with CBMA coordinates	Picture-based (N = 4), Cue-based (N = 5)	Photos of limbs in painful situations (self and other)	Different activation patterns in picture-based and cue-based paradigms. Similar results for CBMA and image-based	7 out of 16
Gu et al., 2012⁴³	CBMA (28)	Until Aug 2010	HP & AI/ACC cortex lesions	Analyze AI and ACC	Perceive and share others' pain	Explicit pain evaluation in others or implicit induction of affective sharing	Valence rating, empathic decision, perspective taking	Photos of other person limbs in painful or non-painful situations	AI and dACC involved in EfP	7 out of 16
Coll, 2018⁴⁴	ERP (36)	2008 to 2018	HP & clinical cases	Assess ERP response	Ability of individuals to share the experience of others	Scalp ERP data in response to pictures showing nociceptive stimulations	Watch/empathize with faces, pain rating	Photos of body parts and faces in painful situations	LPP and P3 components sensitive to the observation of pain in others	12 out of 16
Timmers et al., 2018⁴⁰	CBMA (128)	2003 to 2017	HP	Identify neural networks	Share affective and sensory states	fMRI or PET studies during an empathy task	Empathy for pain tasks, pain rating	Photos/videos of pain scenarios	EfP and empathy for non-painful negative affective states share neural correlates	10 out of 16
Xiong et al., 2019⁴⁵	CBMA (8)	Until Dec 2016	HP	Summarize brain signal patterns	Understanding others' emotions	fMRI, only facial expressions	Watching photos/videos of facial expressions	Photos/videos of facial expressions	Pained facial expression associated with specific brain patterns	6 out of 16
Jauniaux et al., 2019¹¹	CBMA (86)	No time restriction	HP & clinical cases	Identify neural networks	Multidimensional construct	fMRI whole-brain analysis with visual stimuli, nociceptive stimulations or a EfP condition	Rate/evaluate empathy, perceived unpleasantness, or pain's intensity	Visual cues in 3 perspectives (self, other, both)	A core network was identified across various cues and visuospatial perspectives. Specific findings for each perspective	8 out of 16
Ding et al., 2020⁴⁶	CBMA (103)	-	HP	Identify neural networks	Share and infer cognitive/affective states	fMRI whole-brain analysis, comparing conditions in empathy relevant tasks	Rate/evaluate/judge pain, empathy, and mental states	Painful/emotional/noxious images and videos	Bilateral supplementary motor areas involvement across sub-domains	6 out of 16

HP: Healthy participants; CBMA: Coordinate Based Meta-analysis; ERP: Event-Related Potential; fMRI: functional Magnetic Resonance Imaging; PET: Positron Emission Tomography; AI: Anterior Insula; dACC: dorsal Anterior Cingulate Cortex; LPP: Late Positive Potential; AMSTAR: A Measurement Tool to Assess systematic Reviews.

contributing to volitional control and multisensory integration.⁴³

However, EfP does not rely on a single linear neural pathway and instead recruits secondary and context-dependent networks, the evidence for which is more heterogeneous and methodologically variable. Multiple meta-analyses and systematic reviews indicate that EfP-related neural activations vary as a function of stimulus type and experimental paradigms.^{11,40,45,46} In this context, the coordinate- and image-based meta-analyses conducted by Lamm et al. (2011) represent a particularly influential contribution, despite some methodological constraints (e.g., lack of bias assessment).⁷ Their results provide a coherent functional framework distinguishing two pathways associated with the EfP core network: a cue-based pathway related to action understanding and a picture-based pathway linked to mental state representation. While the picture-based paradigm emphasized bottom-up processes, engaging the inferior and parietal/ventral premotor cortices, the cue-based paradigm involved top-down processes, recruiting areas linked to mental state inference and representation, such as the precuneus, ventral medial prefrontal cortex, superior temporal cortex, and TPJ.

Jauniaux et al. (2019) supplemented these results by showing that the assessment of others' pain in a self-oriented perspective (one's own perspective) and in a stimuli-oriented perspective (focus on the painful stimuli) produced a distinct activation in the left insula, in the inferior frontal and parietal lobules, precentral gyrus and cerebellum compared to the other-oriented perspective (protagonist's perspective). The authors concluded that the secondary networks of EfP are multiple and depend on the source of stimulation but also on the subject's perspective, which is influenced by experimental conditions.¹¹

Finally, the ERP meta-analysis by Coll (2018), which achieved the highest overall methodological quality among the included syntheses, provides particularly reliable evidence for the involvement of later cognitive-motivational components (P3, LPP) in vicarious pain processing.⁴⁴ Their careful assessment of heterogeneity and publication bias strengthens confidence in the conclusion that EfP is more consistently reflected in higher-order evaluative processes than in early affective ERP components, such as N1 and N2. The authors' explicit discussion of methodological variability across paradigms further supports the interpretability of these findings. Fig. 1 summarizes the main structures involved in EfP.

The effect of distal and proximal psychological trauma

Early life adversity. Early empathic responses in childhood are initially driven by primary emotional contagion and progressively integrate cognitive empathy through the development of mentalization skills.^{47,48} Reviews and developmental models consistently indicate that ELA disrupts this trajectory, impairing both emotional understanding and perspective-taking capacities during critical developmental periods.^{28,29} Empirical studies support these models, showing that children exposed to maltreatment or raised in foster care display persistent difficulties in emotion recognition and mentalizing, even after controlling for age, intelligence, and social factors.⁴⁹ These impairments may partly reflect biases in emotional processing, as maltreated children have been shown to over-identify anger in facial expressions.⁵⁰

During adolescence, when socio-emotional systems undergo significant reorganization, ELA-related empathy alterations become more differentiated. Studies in adolescents with callous-unemotional (CU) traits—a phenotype marked by reduced empathy and emotional insensitivity—indicate that ELA is associated with empathy deficits, particularly in affective responsiveness. Neurobiological investigations using fMRI⁵¹ and EMG⁵² have demonstrated that ELA severity modulates reactivity to negative stimuli: moderate levels of adversity are associated with blunted amygdala responses, whereas severe adversity is linked to heightened reactivity. These findings suggest non-linear effects of ELA on emotional processing. Translational evidence further supports this framework, as animal studies have shown that oxytocin administration

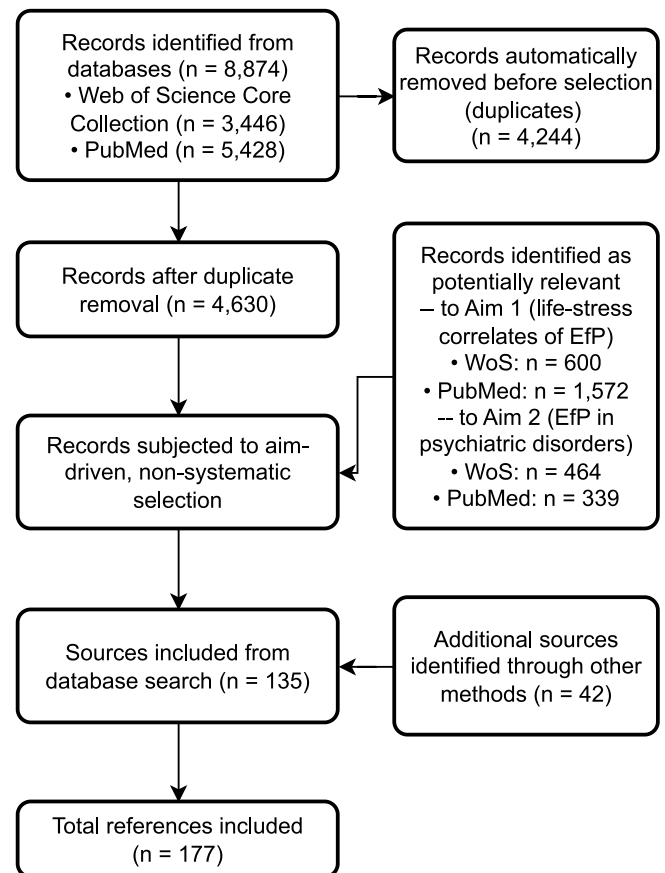


Fig. 1. PRISMA-style flow diagram illustrating the identification, deduplication, and aim-driven selection process of the scoping review. WoS = Web of Science.

can ameliorate behaviors analogous to empathy deficits associated with CU traits, highlighting potential mechanistic pathways relevant to human research.⁵³

In adulthood, evidence regarding the impact of ELA on empathy is more heterogeneous, likely reflecting variability in adversity timing, severity, and psychiatric comorbidity. Population-based studies have reported positive associations between ELA and affective and cognitive empathy,⁵⁴ whereas clinical studies indicate the opposite pattern. For example, adults—particularly women—with post-traumatic stress disorder related to childhood trauma show reduced empathy compared to healthy controls.⁵⁵ Similarly, studies in individuals with BPD report impaired cognitive empathy and diminished perspective-taking, with more severe childhood maltreatment associated with greater deficits.⁵⁶

Beyond environmental exposure, several studies have proposed genetic moderation of the relationship between ELA and empathy.^{57,58} Although initial findings suggest that genetic variability may influence susceptibility to ELA-related empathic alterations, replication across large and ethnically diverse cohorts remains limited. Interpretation of these results is further complicated by the polygenic and context-dependent architecture underlying human social behavior.^{59,60}

Despite substantial evidence linking ELA to empathy impairments and to altered pain-related outcomes—such as increased risk for chronic pain in adulthood⁶¹—relatively few studies (summarized in Table 2) have directly examined the relationship between ELA and EfP. In younger populations, one neuroimaging study reported EfP deficits in preadolescents exposed to maternal depression, characterized by reduced activation in the superior and posterior temporal gyri despite preserved emotion recognition abilities.⁷² Adult studies similarly indicate that ELA differentially affects affective and cognitive components of

Table 2
Proximal and distal stressors in Empathy for Pain (EfP).

Author/Year	Population N	Goal	Paradigm/task Assessment method	Results
Early Life Adversity (ELA) * EfP				
fMRI, MEG and EMG studies				
Pratt et al., 2017 ³⁰	N = 72 preadolescents, 27 with depressed mother, 45 controls	Explore the impact of long-term maternal depression on children' EfP.	<u>Tasks</u> : Emotional Detection Task; EfP task; Mother-child interactions observation. <u>Maternal depression</u> : SCID-I <u>Child symptomatology</u> : DAWBA <u>Confounding factors</u> : father symptomatology with BDI and STAI-T	- Preadolescents of depressed mothers: More anxiety, ADHD, and conduct disorders than controls. - Maternal depression predicts an impaired neural response in EfP with decreased pSTS activation. Emotional empathy is preserved. - Mother-child relational patterns during childhood mediate the effect of maternal depression on EfP in adolescents.
Flasbeck, Enzi and Brüne, 2017 ⁶⁵	N = 93 46 BPD 47 controls	Explore ERP responses in BPDs in a specific pain empathy task.	<u>Task</u> : Social Interaction Empathy task in which participants had to evaluate the level of physical and moral pain based on pictures, either in the 1st or 3rd person. <u>ELA</u> : CTQ <u>Trait empathy</u> : IRI	- BPD participants do not distinguish between physical and moral pain in 1st person but do in 3rd person, unlike controls. - Early trauma in BPDs associated with lower perspective taking and increased personal distress (IRI). - Early trauma and personal distress predict ERP response magnitude only in BPDs.
Genetic studies				
Flasbeck et al., 2018 ⁶²	N = 302 148 female BPD 154 female controls	Explore the impact of ELA on EfP associated with the genetic variation of OXTR rs53576.	<u>Task</u> : Social Interaction Empathy task in which participants had to evaluate the level of physical and moral pain based on pictures, either in the 1st or 3rd person. <u>ELA</u> : CTQ <u>Trait empathy</u> : IRI	- Individuals with the Ars53576 allele show increased sensitivity to early trauma on their empathic capacity across all groups. - ELA, especially in those with the Ars53576 allele, leads to increased negative reactivity/distress to others' psychological suffering.
Cross-sectional study				
Locher et al., 2014 ⁶³	N = 49 South Africans who experienced apartheid	Explore the relationship between early trauma and empathy for emotional pain.	Mixed-method study <u>Paradigm</u> : Viewing film clips of victims of infanticide and perpetrators during Apartheid. <u>ELA</u> : CTQ <u>Emotional distress</u> : 9-point Likert scale <u>Qualitative</u> : Open-ended questions on participants' emotions and thoughts.	- Moderate early trauma: Significantly lower empathic responses than no or low trauma. - Severe early trauma: Increased emotional distress and quantitative empathy but decreased qualitative empathy.
Adult Stressors * EfP				
fMRI/GEM studies				
Levy et al., 2019 ⁶⁶	N = 88 mothers 41 exposed to war trauma in Israel 47 controls	Explore the impact of chronic stress on empathy for moral and physical pain, at the neural and behavioral levels.	<u>Task 1</u> : Viewing photos of children in distressing or neutral situations. <u>Task 2</u> : Viewing images of limbs in pain or neutral situations. Mother-child interactions observation.	- Task 1: Trauma-exposed mothers show less empathic behaviors toward their children but no differential neural activity. - Task 2: Trauma-exposed mothers show no gamma oscillations in medial frontal gyrus, ACC, and AI, indicating decreased empathic response. - Mother-infant synchrony and reduced EfP response mediate the relationship between trauma and empathic abilities in adolescents. - Proposes a model of intergenerational transmission of altered empathy in chronic stress.
Experimental studies				
Loren et al., 2015 ⁶⁷	Experiment 1: mice Experiment 2: students	Evaluate the impact of stress on pain empathy in mice and humans.	<u>Mice</u> : Glucocorticoid inhibitor (metyrapone) or vehicle in pain situation (acetic acid abdominal constriction test). <u>Humans</u> : Cold pressure test to rate pain intensity and unpleasantness in friends or strangers. Participants treated with metyrapone or placebo, and intranasal oxytocin or placebo. Stress level: Salivary cortisol Confounding factors: Mood, catastrophizing, trait empathy.	- Social stress (dyad with a stranger) decreases EfP in both mice and humans. - Glucocorticoid inhibition promotes emotional contagion. - Sharing a social experience with a stranger (cooperative video game) improves empathic response in the cold press test.

fMRI: functional Magnetic Resonance Imaging; MEG: Magnetoencephalography; EMG: Electromyography; CTQ: Childhood Trauma Questionnaire; ACC: Anterior Cingulate Cortex; pSTS: posterior Superior Temporal Sulcus; SCID-I: Structure Clinical Interview for DSM-IV Axis I; DAWBA: Development and Well-Being Assessment; BDI: Beck Depression Inventory; STAI-T: State-Trait Anxiety Inventory, Trait version; IRI: Interpersonal Reactivity Index. BPD: Borderline Personality Disorder; OXTR: Oxytocin Receptor; ERP: Event-Related Potential; AI: Anterior Insula.

EfP as a function of adversity severity.⁶²⁻⁶⁴ In non-clinical samples, severe ELA has been associated with heightened emotional empathy but reduced cognitive empathy, whereas moderate adversity is linked to reductions in both.⁶³ Converging evidence from clinical samples of women with BPD further supports a dose-dependent relationship between ELA severity and EfP-related neural responses, as reflected in event-related potential magnitudes.^{62,64}

Proximal adversity. Regarding stress in adulthood, the effect on empathy seems to vary depending on whether it is acute (i.e. reactive stress to a circumscribed, time-limited anxiogenic event/factor, with return to baseline state after exposure) or chronic (i.e. ongoing stress linked to exposure to repeated and prolonged anxiogenic events/factors and/or to an anxiety disorder) as well as the type of stressor. A recent literature review suggests that acute stress typically inhibits the emotional empathy response, although contextual factors should be considered.³³ The impact of past stressful events on empathy-related brain activation appears to depend on the specific nature and context of the experience. A study comparing White and Black South Africans viewing apartheid crimes found that individuals with greater cumulative social adversity exhibited heightened social information processing, while others showed a tendency for emotional blunting.⁶⁸

Findings on chronic stress are mixed and appear to vary by population. For example, the stressful conditions at work have been found to impact the long-term capacity for empathy among medical students.⁶⁹ However, anxious individuals, who are exposed to persistent distress, seem to have higher levels of empathy than less anxious ones.^{70,71} This view is supported by a neuroimaging study that showed convergent neural correlates between empathy, worry, and rumination.⁷² People with social anxiety have a high sensitivity to negative social cues that may promote affective sharing with others (emotional empathy). Nevertheless, these same subjects may have a mentalization bias (cognitive empathy), i.e., a tendency to over-infer negative emotional attributions to others.⁷¹

Examining the impact of immediate stressors on EfP (Table 2), a dual study involving mice and undergraduate students revealed that stress exposure decreases empathy levels. Students paired with strangers

exhibited lower empathy, likely due to heightened social stress during a cold-water pain assessment task. Notably, pharmacological interventions blocking glucocorticoid synthesis or adrenal stress receptors increased emotional empathy in both humans and mice, irrespective of gender.⁶⁷

Concerning the effect of chronic stress, Levy et al. (2019a, 2019b) used two paradigms to assess empathy for moral and physical pain in mothers persistently exposed to military operations and non-exposed controls.^{66,73} War-exposed mothers showed no differences in empathic response during the moral pain paradigm but a decreased empathic behavior with their child.⁶⁶ During the EfP task (images of injured limbs vs neutral), MEG results showed an absence of gamma oscillations in the IA, ACC, and medial frontal gyrus, reflecting a decreased sensitivity to vicarious pain in war-exposed mothers compared to controls.⁷³ Fig. 2 summarizes the effects of distal and proximal stressors on EfP (Fig. 3).

Empathy and personality traits

Individual differences in personality are commonly described using the five-factor model (FFM, or Big Five),⁷⁴ which is the most widely used framework in studies examining the relationship between personality traits and dispositional empathy in non-psychiatric populations. Most available studies rely on FFM-based measures and consistently show that personality traits are reliable predictors of empathy. Because only one study has directly examined EfP, the evidence reviewed here primarily concerns empathy as a broader construct.

Across studies, empathy is most strongly associated with agreeableness, which is consistently linked to prosocial behavior and the quality of social interactions.⁷⁵⁻⁷⁸ This association has been observed in both adolescent^{79,80} and adult samples^{75,81-88} across multiple countries. Openness also emerges as a positive, though weaker, predictor of empathy and is more often related to cognitive aspects of empathy,^{87,88} whereas agreeableness is more closely associated with emotional empathy. Conscientiousness has also been linked to empathic abilities, although less consistently.^{75,79,89}

Similar patterns have been reported using alternative personality models, particularly in healthcare populations.⁹⁰⁻⁹² Traits related to activity, sociability, reward dependence, and

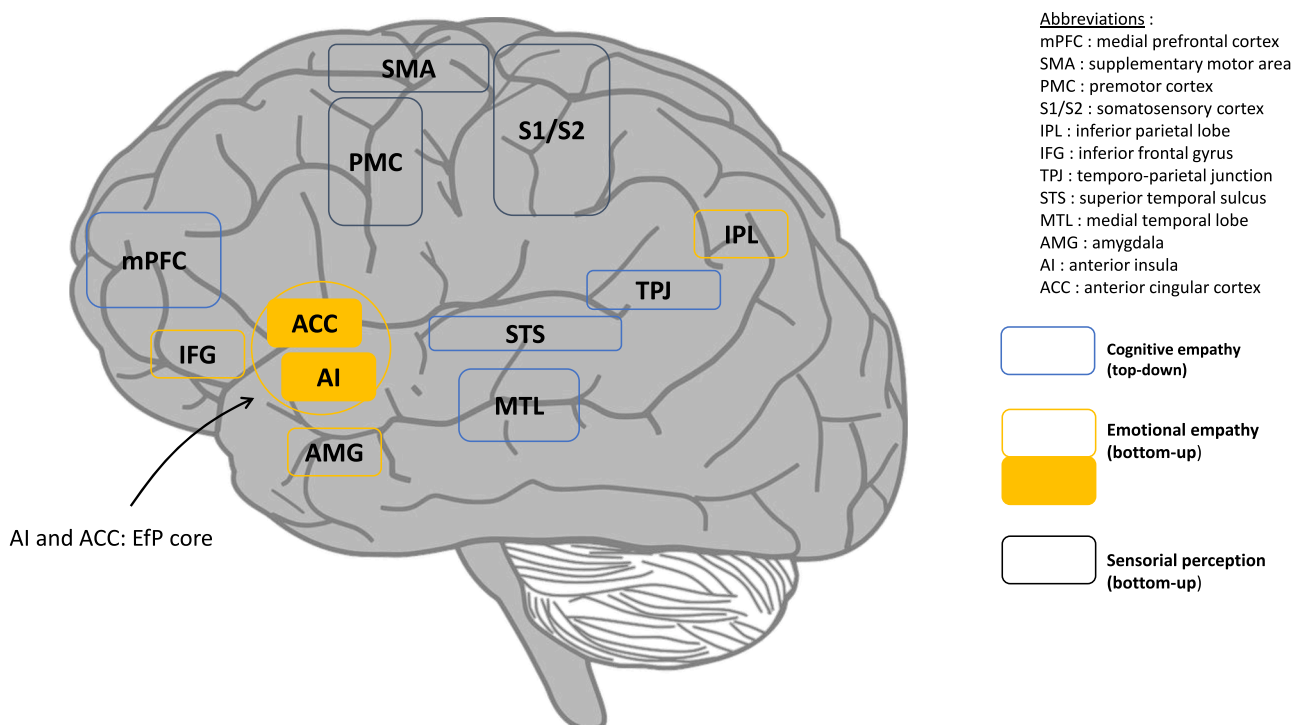


Fig. 2. Main cerebral structures involved in EfP.

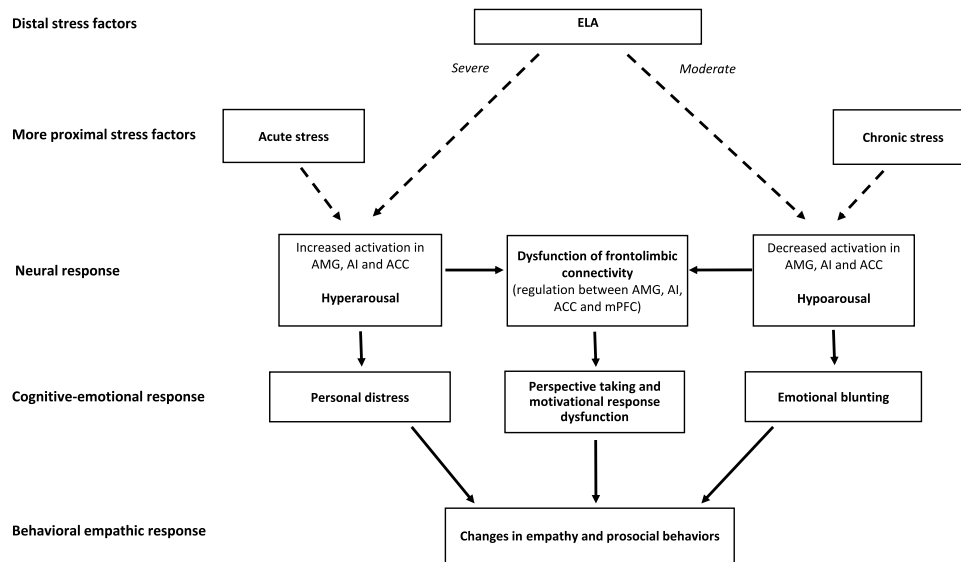


Fig. 3. Effect of distal and proximal stressors on the Efp process.

cooperativeness—conceptually overlapping with extraversion and agreeableness in the FFM—have been positively associated with empathy in medical students.^{91,92} In contrast, neuroticism shows a different pattern: it is positively associated with personal distress^{80,87,93}—reflecting self-focused emotional reactivity to others’ suffering—and is generally negatively associated with overall empathy.^{80–82,86} This distinction highlights the importance of differentiating empathic concern from emotional contagion when interpreting personality–empathy relationships.^{94,95}

The only study specifically examining Efp reported findings consistent with the broader literature on trait empathy and personality constructs. In two experiments conducted in healthy adults, Courbalay et al. (2015) showed that agreeableness and conscientiousness were associated with greater perceived intensity of others’ pain based on facial expressions. Among individuals high in conscientiousness, engagement in prosocial behaviors increased with the intensity of painful facial expressions. In contrast, individuals high in neuroticism were more likely to engage in helping behaviors after learning about a potentially critical prognosis, even at lower levels of expressed pain. The authors suggest that anxiety and worry associated with neuroticism heighten sensitivity to perceived threat.⁹⁶

Efp and psychiatric disorders

Empathy dysfunctions are common across psychiatric and neurodevelopmental disorders,^{97–101} but alterations in Efp are not uniform. Rather, clinical conditions tend to diverge along a sensitization–blunting continuum, with either reduced affective resonance or heightened but dysregulated responding, depending on how emotional, cognitive, and regulatory components of empathy are affected.¹⁰²

A blunted Efp profile—characterized by reduced affective sharing—has been most consistently described in psychopathic traits and narcissistic personality disorder,^{103,104} and in CU traits (mainly studied within conduct disorder).^{51,52,103} By contrast, in autism-spectrum disorders (ASD) and schizophrenia, empathy alterations are more often expressed at the cognitive/mentalizing level, with difficulties in perspective-taking and interpretation of others’ states.^{105–107} At the other end of the continuum, some conditions may involve heightened but poorly regulated Efp: borderline personality disorder, for example, is often associated with marked emotional reactivity alongside impairments in cognitive empathy and mentalizing.^{103,105,106} Evidence in MDD and substance use disorders (SUDs) remains more limited but suggests that Efp may vary with symptom severity and motivational

context rather than reflecting a single fixed deficit.⁹⁹

Personality disorders

Borderline personality disorder. BPD, characterized by emotional instability and self-injurious behavior,^{107–109} may result from neural adaptations to early trauma and dysfunctional family relationships.^{110,111} Studies indicate BPD patients struggle with “mentalizing” others’ mental states,^{105,106,112,113} showing intact or heightened emotional empathy but impaired cognitive empathy compared to controls.^{114–116} Regarding emotion recognition, some studies found no significant differences between BPD patients and healthy controls, while others reported hypersensitivity to negative emotions and a tendency to assign negative emotions to neutral facial expressions.^{116–121} However, results on the role of empathic processes as a source of impaired interpersonal functioning in BPD are inconsistent.^{97,122,123} An emblematic example is the “empathic paradox” in BPD which refers to the ability to recognize emotional states in others, without the corresponding ability in interpersonal relationships.¹²⁴

Available results about Efp process in BPD include one behavioral study⁶⁴ and two fMRI studies^{17,18} using paradigms that compared photos depicting moral pain, physical pain, and neutral scenes. These studies are summarized in Table 3.

In a Social Interaction Empathy Task and compared to healthy controls, BPD patients evaluated psychological pain as more intense when imagining themselves in the presented situations vs imagining someone else’s feelings in the same situation. Inversely, they judged physical pain as less painful for themselves than for other people. This work found that psychological pain in BPD was correlated with symptom severity.⁶⁴ The same research team also investigated fMRI correlates of a Efp task in a small sample: viewing images with facial emotions in different combinations (angry, happy, neutral, or painful expressions) prior to pictures of hands exposed to painful/non-painful stimuli.¹⁸ BPD patients, compared to controls, showed a selectively enhanced activation in the right supramarginal gyrus to the combination of painful facial expressions and hands exposed to painful stimuli and a lower activation to angry expressions, independently of the subsequent images. In addition, BPD patients exhibited differential activation of the left AI depending on the facial emotion shown. In the same vein, a study that looked at empathy for emotional pain showed greater activation of the Mirror Neuron System (somatosensory and premotor cortex) involved in emotional contagion among BPD patients compared to controls when exposed to images of people in moral distress (grief).¹⁷

Table 3

Empathy for Pain (EfP) in Borderline Personality Disorder (BPD), Conduct Disorder (CD), psychopathic traits and Narcissistic Personality Disorder (NPD).

Author	Population	Goal	Paradigm/Task	Assessment Method	Results
Borderline Personality Disorder and EfP					
Flasbeck et al. 2017 ⁶⁴	N = 98 50 BPD 48 controls	Compare empathy for physical and psychological pain in BPD	Social Interaction Empathy Task: Rate pain from pictures of social, physical, or neutral pain	IRI Toronto Alexithymia Scale CTQ	- BPD: Higher ratings for neutral and psychological pain in 1st person. - No difference in physical pain assessment. - Lower Perspective Taking, higher Personal Distress. - Higher alexithymia and earlier trauma. - Early trauma correlates with alexithymia and Personal Distress, and negatively with Perspective Taking. - Alexithymia mediates link between early trauma and psychological pain ratings.
Flasbeck et al. 2019 ¹⁸	N = 39 20 BPD 19 controls	Compare empathy response to pain in BPD considering emotional context	fMRI: Empathy task with emotional facial expressions followed by painful or neutral situations	IRI	- BPD: Greater right supramarginal gyrus activation for painful situations after painful faces. - Decreased activation for nonpainful situations after angry faces. - Higher Personal Distress, lower Perspective Taking.
Sosic-Vasic et al. 2019 ¹⁷	N = 40 women 20 BPD 20 controls	Compare empathy for moral pain in BPD	fMRI: Scenes depicting individuals reacting to loss or neutral content	SCID-II for axis I disorders NEO-FFI for personality traits	- BPD: Increased sensory-motor areas activation, decreased inferior frontal gyrus activation.
Conduct Disorder and EfP					
Lockwood et al. 2013 ¹²⁵	N = 55 children 37 CD 18 controls	Determine if CU traits correlate with decreased neural activity in CD	fMRI: Participants watched images of a hand or foot receiving painful or non-painful stimulus	ICU	- CD children: Reduced AI and ACC activity (affective empathy deficits), reduced IFG activity (cognitive empathy deficits). - Negative correlation between CU traits and AI/ACC response.
Michalska et al. 2016 ¹²⁶	N = 107 children 54 CD 53 controls	Assess if neural response to harm predicts CD symptoms	fMRI: Viewed video clips of intentional/unintentional harm, or neutral situations	DISC Predictive Scale ICU subscale Reactive-Proactive Aggression scale	- High CU traits: Decreased right PI and aMCC activation. - High conduct problems: Decreased right PI signal for intentional harm.
Dong et al. 2017 ¹²⁷	N = 66 adolescents 30 CD 36 controls	Explore neural response of EfP associated with CD in adolescents	fMRI: Shown painful (needle) or non-painful (cotton) stimulus images	IRI APSD for CU traits Buss-Perry Aggression Questionnaire SDQ	- CD adolescents: Lower bilateral Temporo Parietal Junction response (cognitive empathy deficits).
Psychopathic traits and EfP					
Meffert et al. 2013 ¹²⁸	N = 44 18 psychopathic offenders 26 controls	Explore neural response of EfP in psychopathy	fMRI: Video clips of two hands interacting in various ways	PCL-R	- Psychopaths: Reduced premotor, somatosensory, AI, and ACC response. - Group differences reduced when instructed to empathize.
Decety et al. 2013 ¹²⁹	N = 121 incarcerated men 37 high 44 intermediate 40 low psychopathic traits	Explore neural response in affective perspective taking in psychopathy	fMRI: Self or other-perspective viewing of painful and neutral limbs	PCL-R	- High traits: Typical/increased neural response in self-perspective (AI, aMCC, IFG, SMA, somatosensory cortex, right AMG), altered response in other-perspective (AI and AMG connectivity with orbitofrontal and ventromedial prefrontal cortex).
Branchadell et al., 2024 ¹³⁰	N = 100 students	Explore the influence of perspective taking on electrocortical processing of EfP in CU traits	EEG with ERP: Pictures of hands and feet in painful or non-painful situations, presented in self- and other perspectives	TriPM LSRP ICU	- CU traits predicted reduced LPP amplitudes in the other- perspective.
Atanassova et al., 2025 ¹³¹	N = 74 community participants	Explore pain tolerance and EfP in psychopathic traits.	Pain assessment: Electrical and cold pain threshold and tolerance EfP task: Pictures of hands and feet in painful or non-painful situations, presented in self- and other-perspectives	SPR-SF Questionnaire of Cognitive and Affective Empathy	- Higher psychopathic traits were associated with increased electrical pain tolerance and lower fear of pain. - Reduced pain tolerance contributed to diminished EfP in other-perspective, through lower pain ratings in the self-perspective.
Alshukri et al., 2025 ¹⁹	N = 573 participants from the general population	Synthesize findings on pain and EfP processing related to psychopathic traits in the general population	Systematic review of 8 articles published between 2000 and 2022: - 1 fMRI and 2 EEG studies exclusively on EfP - 1 fMRI and 1 EEG studies on both EfP and pain	Psychopathic traits: TriPM; LSRP; Self-Report Psychopathy scale; SPR-SF; Psychopathy Personality Inventory-Revised Short Form; Elemental Psychopathy Assessment; Minnesota multiphasic personality	- Higher psychopathic traits, particularly meanness: reduced LPP response during EfP task in the other-perspective condition - Boldness traits: reduced N100 and N240 amplitudes during both painful and non-painful EfP conditions

(continued on next page)

Table 3 (continued)

Author	Population	Goal	Paradigm/Task	Assessment Method	Results
			tolerance - 3 experimental studies on pain tolerance only EFP task: Pictures of hands and feet in painful/non-painful situations or confederate paradigm Pain assessment: Pressure or temperature and electrical stimuli	inventory-2-restructured form Empathy: IRI	- Affective-interpersonal traits: decreased neural activation (AI, IFG, midCC, ACC) during EFP - Lifestyle-antisocial traits: increased neural activation (AI, IFG, midCC, ACC) during EFP - Empathy prompt normalized AI response - Higher psychopathic traits, particularly boldness and meanness: increased pain tolerance (electric and pressure stimuli) - Reduced pain sensitivity contributed to modulate EFP response in psychopathic traits.
Narcissistic traits and EFP					
Shahri et al., 2024 ¹³²	N = 87 students 44 high narcissistic traits 43 low narcissistic traits	Compare self- and other-evaluation of physical and social pain in narcissistic traits	Video clips of individuals describing personal experiences of physical and social pain	Narcissistic Personality Inventory-16 Depression and anxiety stress scale-21 Positive and Negative Affect Schedule IRI	- High narcissistic traits: Lower levels of empathic concern, empathic arousal, empathic pain, empathic emotions (task), Personal Distress and Empathic Concern (IRI).

fMRI: functional Magnetic Resonance Imaging; AE: affective empathy; CE: cognitive empathy; SCID-II: Structure Clinical Interview for DSM-IV Axis II; CTQ: Childhood Trauma Questionnaire; IRI: Interpersonal Reactivity Index; NEO-FFI: NEO Five-Factor Inventory; CU: Callous Unemotional; ICU: Inventory of Callous Unemotional Traits; AI: Anterior Insula; ACC: Anterior Cingulate Cortex; PI: Posterior Insula; IFG: Inferior Frontal Gyrus; aMCC: anterior/Medial Cingulate Cortex; midCC: mindCingulate Cortex; PCL-R: Psychopathy Checklist-Revised; AMG: amygdala; EEG: Electroencephalogram; TriPM: Triarchic Psychopathy Measure; LSRP: Levenson Self-Report Psychopathy Scale; SPR-SF: Self-Report Psychopathy Scale, Short Form; LPP: Late Positive Potential; ERP: Event-Related Potential.

These findings together support a hypersensitivity to emotional suffering in BPD, involving an increased neuronal response in regions that underlie the affective and motor dimensions of EFP (AI, supra-marginal gyrus, sensory-motor areas). This phenomenon of increased resonance to moral pain may contribute to both the emotional dysregulation and relational adjustment difficulties that characterize BPD. In addition, variations in stimulation type (moral vs. physical), emotional valence (e.g., anger), and perspective (first- vs. third-person) highlight key modulating factors that can either enhance or diminish EFP in individuals with BPD, offering valuable insights for therapeutic interventions. Mentalization-Based Treatment (MBT), which strengthens the ability to understand one's own and others' mental states in emotionally challenging situations,¹³³ has shown equal or superior effectiveness in reducing BPD symptoms compared to standard treatments, such as dialectical behavior therapy or psychodynamic therapy.¹³⁴

Conduct disorder, antisocial and narcissistic personality disorders. In childhood and adolescence, conduct disorder (CD) is characterized by a repetitive and persistent pattern of behavior in which the basic rights of others are violated.¹⁰⁷ Youth with CD shows functional differences in the frontotemporal-limbic connections involved in processing and regulating affects compared to individuals without.¹⁰⁷ Several ERP and fMRI studies have explored emotional vs. cognitive EFP in children and adolescents with CD and CU traits compared to typically developing individuals using behavioral paradigms (e.g., scenarios of intentional vs. unintentional pain being inflicted). These studies are summarized in Table 3.

CU traits are associated with altered neural processing, as measured with ERPs, during the perception of people in pain.^{127,135} Decreased hemodynamic activity in the insula, the ACC and the TPJ in children with CD while observing pain suggests a dampening in their emotional and cognitive empathic response. Moreover, as the amount of CD traits increases, activation in these brain areas weakens.¹²⁶ Children with CD show decreased connectivity between the amygdala and the frontal/parietal region in response to observing intentionally-induced pain.¹³⁶ Consistent with this, a reduction in the activation in the AI and dorsal ACC was found in a sample of adolescent boys with CU traits¹²⁵ and in a

sample of psychopathic adolescents.¹³⁷

In adulthood, antisocial personality disorder (AsPD) is defined by a pervasive pattern of disregard for and violation of the rights of others with a lack of remorse.¹⁰⁷ In contrast, psychopathy is a broader clinical construct encompassing personality traits not captured by the AsPD criteria.¹³⁸ Psychopathy is widely conceptualized as a two-factor model, including interpersonal and affective impairment such as manipulation and emotional coldness (Factor 1), alongside antisocial lifestyle (Factor 2), the latter overlapping with AsPD.^{139,140} Although AsPD and psychopathy frequently co-occur in forensic populations, they appear to reflect distinct empathy impairments. A meta-analysis comparing empathic profiles across AsPD and psychopathic traits reported greater deficits in cognitive empathy in antisocial but non-psychopathic individuals, while high psychopathic traits were more strongly associated with reduced affective empathy. This association appears to be primarily driven by CU traits, which reflect a marked dysfunction in emotional resonance with others.¹⁰³

The literature specifically addressing EFP has primarily focused on psychopathic traits in non-clinical populations. A systematic review of eight studies examined pain tolerance and EFP in individuals from the general population with varying levels of psychopathic traits ($N = 573$). It reported reduced neural activity in EFP-related regions in tasks requiring perspective-taking. This blunted EFP response was selectively associated with affective-interpersonal traits, including meanness and boldness, which were also linked to higher nociceptive pain tolerance. In contrast, an increased activation in AI, IFG, midCC and ACC was found among individuals with higher lifestyle-antisocial traits in response to others' pain.¹⁹ Moreover, an EEG study showed that CU traits predicted lower LPP amplitude during other-perspective EFP tasks in a student sample.¹³⁰

To date, only two fMRI studies^{128,129} have investigated neural responses to EFP in incarcerated individuals with high psychopathy (Table 3). Meffert et al. (2013) reported reduced activation in pain-related neural network during an empathy task involving various emotional stimuli (i.e. videos of painful touches) in a sample of adult psychopathic offenders compared to controls.¹²⁸ However, the other fMRI study found opposite results: increased activation in the AI during an EFP task in a sample of incarcerated psychopathic men compared with

healthy subjects.¹²⁹

Narcissistic Personality disorder (NPD) is characterized by impairments in self and interpersonal functioning, encompassing a pervasive pattern of grandiosity, need for admiration, and lack of empathy.¹⁰⁷ NPD is typically described along two main dimensions: grandiose narcissism, which involves overt expressions of superiority and dominance, and vulnerable narcissism, which reflects low self-esteem, emotional insecurity, and hypersensitivity to criticism leading to avoidant behaviors.¹⁴¹ While NPD, AsPD, and psychopathic traits overlap,^{142,143} grandiose narcissism is recognized as a distinct feature specific to NPD.^{144,145}

Research on NPD consistently points to reduced emotional empathy in both grandiose and vulnerable narcissism.^{104,146} In contrast, findings on cognitive empathy vary depending on the use of self-report versus behavioral measures.¹⁴⁶ Shahri et al. (2024) exposed students with high and low levels of grandiose narcissistic traits to video clips of individuals describing experiences of physical or social pain. Higher narcissistic traits were associated with reduced affective empathy, reflected in lower pain perception and attribution, as well as diminished affective sharing.¹³²

Collectively, these findings indicate that EfP follows distinct trajectories depending on dominant personality traits in adulthood. Affective-interpersonal dimension, grandiosity and CU traits are associated with impairment in the primary process of emotional resonance, whereas the antisocial dimension when isolated appears to be linked with heightened neural response in vicarious pain contexts. Pain tolerance and perspective-taking emerge as modulatory factors influencing EfP among individuals with psychopathic traits. For instance, Berluti et al. (2020) demonstrated that attentional manipulations can partially normalize neural responses during EfP, suggesting that empathy deficits may be reversible with targeted cognitive engagement.¹⁴⁷ Furthermore, a recent randomized controlled trial found that MBT significantly reduced criminal recidivism among males with AsPD under community probation.¹⁴⁸

Psychiatric and neurodevelopmental disorders (excluding personality disorders)

Autism spectrum disorder and schizophrenia. ASD and schizophrenia disrupt empathic abilities due to intrinsic physiological changes. Both disorders are linked to deficits in the theory of mind, overlapping with cognitive empathy and reflecting a decreased ability to infer others' intentions.^{36,149}

Studies investigating the EfP processes in schizophrenia employed various behavioral paradigms coupled with brain activity recordings (fMRI, EEG, ERP) or assessments like the Stroop test, evaluating cognitive interference inhibition in adult patients. In ASD, research has primarily focused on differences in behavioral performance, brain structure, and neural circuit functioning when comparing neurotypical individuals with those on the autism spectrum.¹⁵⁰⁻¹⁵³ These studies are summarized in Table 4.

Overall findings indicate deficits in the cognitive aspects of EfP in schizophrenia, contributing to impaired social cognition, characterized by TPJ involvement and altered late positive centro-parietal ERPs.^{149,156} The AI and anterior middle cingulate regions in patients with schizophrenia responded to affective empathy tasks similarly to normal controls.^{149,155} Hu (2015) proposes a "two-opposing effect model," demonstrating that painful vs. non-painful stimuli slowed reaction times in neutral trials for both patients and controls, while EfPful stimuli reduced reaction times in controlled cognitive processing more in patients, potentially enhancing executive function and suggesting therapeutic implications for schizophrenia.¹⁵⁴

In ASD, empathic responses to pain vary depending on the nature of the stimulus. Specific factors like the anatomical area that was observed to receive the painful stimuli, the time spent observing it¹⁵⁰ as well as

the sensory pathway used to perceive the painful stimuli (e.g., visualizing it or hearing it) affected the response of different areas of the brain to pain. The thalamus and the inferior frontal gyrus were found to be related to empathic response to pain when the painful stimulus was directed at limbs rather than faces, however, individuals with autism showed less strong response, especially in the secondary somatosensory cortex.¹⁵¹ Audible pain stimuli resulted in a diminished neural response compared to visual stimuli in individuals with greater autistic traits,¹⁵² and in individuals with Asperger Syndrome neuromodulation of the corticospinal tract was decreased when compared to neurotypical individuals.¹⁵³

Depressive disorders and substance use disorder. While high empathy is linked to positive interpersonal outcomes, excessive empathy for others' distress has been associated with an increased risk of depression.¹⁵⁹ In MDD, impairments in both cognitive and emotional empathy have been found depending on the studies, which potentially reflect increased sensitivity to negative emotional cues and corresponding deficits in executive control.⁹⁹ In SUD, alcohol dependence has been linked to impairment in affective processing (emotional empathy), which is implicated in alexithymia as well as interpersonal difficulties.⁹⁹

Limited research exploring empathic responses to pain in individuals with depressive disorders has revealed associations between depressive symptoms, empathy, and responses to antidepressant pharmacotherapy.^{20,21} In SUD, researchers have been interested in the connection between empathy and the opioid system and multiple studies have linked analgesics with EfP.^{157,158} Studies discussed below are summarized in Table 4.

Fujino et al., (2014) found a decrease in activation in the brain areas known to mediate empathic response as well as lower self-rated pain in patients with MDD compared to healthy controls, when performing an empathy task during fMRI. Factors such as a deficit in cognitive functions often seen in depression, inability to verbalize pain²⁰ and emotional transference¹⁵⁹ have also been suggested to possibly play a role in decreased EfP in MDD. Other studies did not find an association between depressive symptoms and an altered response to EfP. Rütgen et al. (2019) found no difference between self-rated empathy and neural response to an EfP task in MDD vs. healthy control group. However, treatment with serotonergic antidepressants reduced affective empathy and the neural response in brain areas related to EfP.²¹ These findings suggest that serotonergic agents could protect against depression by decreasing the aversive affective response that is elicited in individuals when they witness or experience negative life events.

Concerning the opioid system, acetaminophen, known to inhibit neural activity in areas associated with affective empathy such as AI and ACC, as well as placebo, were found not only to suppress physical pain but also to diminish one's ability to empathize with others' pain experiences.^{157,158} Nalmefene, an opioid receptor antagonist, increased pain perception and EfP in patients with alcohol use disorder, suggesting a potential role for opioid system modulation in EfP and overall empathy.¹⁵⁸ These findings underscore the complex interplay between analgesic agents and empathic behavior, with implications for treating SUDs.^{157,158}

Discussion

EfP brings together the processes of empathy and pain, enabling us to share and feel the suffering of others. Empathic dysfunction and impaired interpersonal relationships are common to many categories of psychiatric disorders.^{20,135,160-165} By encompassing affective, cognitive and motivational processes implicated in response to one's own suffering and that of others, EfP offers a particularly relevant window into the study of alterations in emotional and interpersonal functioning both in general and clinical populations.

Advances in neuroimaging have highlighted the central role of the AI

Table 4

Empathy for Pain (EfP) in autism-spectrum disorders (ASD), schizophrenia (SCZ), major depressive disorders (MDD), and substance use disorders.

Author	Population	Goal	Paradigm/Task	Assessment Method	Results
Autism Spectrum Disorders and EfP					
Minio-Paluello et al. 2009 ¹⁵³	N = 36 (16 AS, 20 controls)	Neurophysiologic evidence of empathy deficits in autism	EMG with TMS: Observing images of a static hand, hand pierced by needle, hand touched by cotton, and tomato pierced by needle	Motor evoked potentials	- AS participants showed no corticospinal modulation on EMG, unlike controls.
De Coster et al. 2018 ¹⁵⁰	N = 40 (20 HFA, 20 controls)	Differentiate self vs. other in empathy response for pain	Video-clip of a pain stimulus with Self vs. Other distinction paradigm; blink reflex modulation and skin conductance	Behavioral empathy response to pain measured with Batson scale	- HFA: Increased empathic response over time in Imitation condition; decreased response in No Imitation condition.
Lassalle et al. 2018 ¹⁵¹	N = 31 (16 ASD, 15 controls)	Explain brain activation inconsistencies in pain observation	fMRI: Videos of faces and limbs receiving painful/harmless/digesting stimulus		- ASD: Different activation in thalamus and inferior frontal gyrus for painful limb stimuli. - Controls: Increased activation in secondary somatosensory cortex (SII) in postcentral gyrus.
Meng et al. 2019 ¹⁵²	N = 30 (15 high AQ, 15 low AQ)	Role of top-down attention in empathy for pain	ERP: Visual (35 painful, 35 non-painful pictures) and auditory (20 painful, 20 neutral prosody) stimuli; Attention to pain/no pain tasks	Autistic traits scale: AQ	- High-AQ: Suppressed N1 and P2 amplitudes for painful vocal stimuli when instructed to ignore pain cues. - No significant difference in visual stimuli response between high and low AQ groups.
Schizophrenia and EfP					
Hu et al. 2015 ¹⁵⁴	N = 48 (27 SCZ, 21 controls)	Effect of empathy for pain on cognitive processing	Color-word Stroop task preceded by painful/non-painful image		- Empathetic pain slowed reaction time in Stroop task for both groups. - EfP decreased reaction time in cognitive tasks, with greater effect on SCZ patients.
Horan et al. 2016 ¹⁵⁵	N = 42 (21 SCZ, 21 controls)	Neural correlates of experienced vs. observed pain	fMRI: Aversive sound tones; participants imagine self vs. other feeling the tones		- Comparable AI and dACC activation when observing others' pain. - Controls showed greater activation for self vs. others in dACC and AI; SCZ patients did not.
Vistoli et al. 2017 ¹⁴⁹	N = 48 (27 SCZ/schizoaffective, 21 controls)	Neural correlates of affective and cognitive empathy	fMRI: Rating pain level (0–100) when watching hand in painful/non-painful situations, imagining self vs. others	Empathy scale: IRI	- No significant difference in AI and aMCC activation between groups. - Bilateral TPJ response affected by visual perspective in cognitive perspective-taking.
Varcin et al. 2019 ¹⁵⁶	N = 36 (17 SCZ, 19 controls)	Abnormal neural response in SCZ patients	ERP: Color pictures of painful/neutral hand stimulation	EEG with ERP; Empathy scale: IRI	- SCZ: Abnormal neurophysiological responses in early automatic (N110) and late controlled cognitive (LPP) processing stages of empathy for pain.
Major Depressive Disorder and EfP					
Fujino et al. 2014 ²⁰	N = 22 (11 MDD, 11 controls)	Neural basis of empathic ability in MDD patients	fMRI: Videos of painful/non-painful stimuli, rating perceived pain intensity	HDRS	- MDD: Lower pain self-ratings and cerebral activation in left MCC and right somatosensory cortices; greater activation in left inferior frontal gyrus. - Pain ratings did not correlate with HDRS severity or antidepressant use.
Rütgen et al. 2019 ²¹	N = 64 (29 MDD, 35 controls)	Effects of untreated depression and antidepressants on empathy	fMRI: Watching pain videos, experiencing pain, and rating cognitive/affective empathy	Empathy scales: IRI, ECS; Emotion Regulation Questionnaire (ERQ); HDRS	- No baseline differences in empathy ratings or neural response. - Post-treatment: Decreased AI and aMCC response, correlated with decreased depressive symptoms. - Antidepressants may reduce aversive response to others' suffering.
Substance Use Disorders and EfP					
Rütgen et al. 2015 ¹⁵⁷	N = 38 (19 placebo, 19 control)	Test if placebo empathy analgesia and placebo analgesia share neural processes	Participants received placebo pill and rated pain from electrical stimulation on self and others	Empathy scales: IRI, ECS	- Placebo group reported reduced self and observed pain. - Placebo empathy analgesia shares neural substrate with firsthand pain experience.
Rütgen et al. 2018 ¹⁵⁸	N = 57 (20 placebo, 19 placebo-naltrexone, 18 control)	Effect of naltrexone on EfP	ERP: Painful/non-painful electrical stimulation, rating self and others' pain	Empathy scales: IRI, ECS	- Naltrexone increased self-reported pain, EfP, and ERP P2 amplitude.

fMRI: functional Magnetic Resonance Imaging; EEG: Electroencephalogram; ERP: Event-Related Potential; IRI: Interpersonal Reactivity Index; AI: Anterior Insula; aMCC: anterior Midcingulate Cortex; TPJ: Temporo Parietal Junction; dACC: dorsal Anterior Cingulate Cortex; LPP: Late Positive Potential; HFA: High Functioning Autism; AQ: Autism spectrum Quotient; AS: Asperger syndrome; TMS: Transcranial Magnetic Stimulation; EMG: Electromyogram; HDRS: Hamilton Depression Rating Scale; MCC: Midcingulate Cortex; ECS: Emotion Contagion Scale.

and ACC in the shared neural representation of pain experienced by oneself and others, supporting affective sharing—a core component of EfP.^{7,43} Beyond simple mirroring, EfP relies on the integration of complex bottom-up and top-down processes that allow for the perception, evaluation, interpretation, and understanding of another's pain. Together, these processes influence emotional regulation and engagement in prosocial behaviors.^{7,11,40,43–46}

EfP dysfunctions are transdiagnostic features across multiple psychiatric conditions; however, their expression is not uniform but instead depends on distinct empathic profiles, which translate into either hypo- or hyper-resonance to vicarious pain. This “EfP paradox” is supported by accumulating evidence showing that EfP exhibits marked heterogeneity contingent upon diagnostic category, dimensional personality traits, and individual histories of adversity. More specifically, our review highlights that distal and proximal stressors contribute to differential disruption in empathic processing and EfP depending on the severity of adversity exposure.^{30,62–64}

Severe ELA leads to increased affective sharing but altered cognitive empathy, while moderate ELA tends to decrease both domains.⁶³ This mainly concerns empathy for negative emotional stimuli,^{51,52} including moral^{63,65} and physical pain,^{30,65} though these results have not been sufficiently reproduced in the general population. Although this dissonance between cognitive and emotional empathy associated with severe trauma in the EfP process is well documented in BPD,^{17,18,64} this finding appears cross-sectional to psychiatric nosology. In the study by Locher et al. (2014), individuals with severe trauma displayed robust affective empathy responses in an emotional empathic pain task but showed biases in their declarative responses related to context interpretation.⁶³ This alteration in the EfP process can be linked to the hypothesis of frontolimbic dysfunction secondary to massive early recruitment of this connectivity in traumatic childhood contexts.¹⁶⁶

The impact of proximal stressors is more complex, depending on the type, severity, and acute or chronic nature of the stressors. Acute stress favors short-term inhibition of empathic capacities,⁶⁷ while chronic stress, requiring fewer neural resources at any moment, shows a long-term decrease in empathy.^{66,68,69,73} These results align with research linking neuroticism to the personal distress domain of dispositional empathy.^{80,87,93} Neuroticism, associated with greater negative affect and promoted by ELA,^{167–171} leads individuals to mirror others' distress,^{80,87,93} impairing more elaborate empathy components.^{80–82,86} A study on EfP and personality traits found that high neuroticism individuals relied more on verbal cues about pain's potential danger than facial expressions to engage in prosocial behaviors,⁹⁶ possibly due to impaired cognitive empathy processes from ELA and chronic stress.

In the psychiatric literature, increased affective empathy during vicarious pain has been reported not only in BPD but also in individuals with lifestyle–antisocial traits, who can show preserved or even exaggerated neural responses during pain-empathy tasks.¹⁹ Moreover, findings that nalmefene reduces affective resonance during EfP tasks in patients with SUD support the view that increased emotional sharing may contribute to empathic dysfunction in this population.^{158,172} By contrast, interpersonal–affective and CU traits are associated with reduced neural resonance, consistent with attenuated affective and cognitive components of EfP.^{19,130,131} In ASD,^{151,153} schizophrenia,^{154,156} and MDD,²⁰ the most prominent alterations during vicarious pain appear to involve cognitive empathy (e.g., perspective-taking) rather than affective resonance. Taken together, this evidence challenges categorical models that assume uniform empathic deficits within specific diagnoses. Instead, it supports a dimensional reconceptualization in which distinct components of empathy—emotional contagion, perspective-taking, and prosocial motivation—are differentially affected across individuals and clinical presentations.

Based on these findings, we postulate that the “pain-empathy paradox” can be explained by the influence of personality traits on how pain experience affects empathy for others. Whereas individuals with BPD may exhibit heightened affective resonance when witnessing others

in pain^{17,18,64}—sometimes even exceeding typical responses—evidence from studies on psychopathic traits^{19,128,130,131} and NPD¹³² consistently suggests reduced emotional empathy in these populations, despite preserved cognitive empathy.

Finally, the investigation of EfP also informs targeted interventions for empathic dysfunction. Indeed, our findings highlight the need to differentiate therapeutic strategies based on the predominance of cognitive empathy deficits or affective empathy impairments.¹⁷³ Addressing cognitive empathy deficits, EfP studies emphasize the importance of perspective-taking and attentional focus as modulating factors, with evidence that modifying task instructions can normalize empathic responses,^{19,64,128,149} particularly in psychopathy.^{128,174} Moreover, MBT demonstrates efficacy beyond BPD¹³⁴ and promising results have been found for AsPD¹⁴⁸ and NPD,¹⁷⁵ by improving cognitive bias in interpreting mental states of others. Mindfulness-based interventions,¹⁷⁶ which targets affective empathy by promoting interoception and emotional regulation, and empathy training¹⁷⁷ which is mainly grounded in behavioral strategies, yield improvements across various clinical and non-clinical populations. Moreover, serotonergic and opioid systems emerge as modulators of vicarious pain in MDD²¹ and SUD,^{158,172} representing potential pharmacological targets for regulating maladaptive affective responses.

A limitation of the present findings lies in the restricted generalizability of EfP studies to the broader construct of empathy, given that most paradigms employ passive exposure to nociceptive stimuli and thus insufficiently capture higher-order processes such as emotional regulation, moral reasoning and social motivation. This review is also limited by its non-systematic nature given that EfP studies in psychiatric conditions remain scarce and often lack assessment of ELA severity or its association with EfP.

Conclusion

Future research should adopt dimensional models that integrate trauma severity, personality traits, and diagnostic variability in empathic functioning. EfP may offer a valuable framework for understanding core mechanisms of empathy and guiding targeted interventions.

Ethical considerations

This review synthesizes previously published studies and did not involve the collection or analysis of new data from human participants. Therefore, institutional review board (IRB) approval and informed consent were not required. All included studies stated compliance with the Declaration of Helsinki and relevant ethical standards.

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RC and JLC conceived and designed the study. All authors contributed to drafting the manuscript and managed the literature searches and analyses. MS synthesized the literature and compiled the manuscript. All authors revised the article critically. All authors read and approved the final manuscript. There is no one else who fulfills the criteria but has not been included as an author.

Declaration of competing interest

None.

Supplementary materials

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