A Meta-analysis and Systematic Review of Emotion Regulation Strategies in Borderline Personality Disorder

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Abstract: Emotion dysregulation is often considered a core characteristic of individuals with borderline personality disorder (BPD). With the development and strength of a contemporary affective-science model that encompasses both healthy emotion regulation (ER) and emotion dysregulation, this model has increasingly been used to understand the affective experiences of people with BPD. In this meta-analysis and review, we systematically review six of the most commonly studied ER strategies and determine their relative endorsement in individuals with elevated symptoms of BPD compared to individuals with low symptoms of BPD and healthy controls, as well as to individuals with other mental disorders. Results from 93 unique studies and 213 different effect-size estimates indicated that symptoms of BPD were associated with less frequent use of ER strategies that would be considered more effective at reducing negative affect (i.e., cognitive reappraisal, problem solving, and acceptance) and more frequent use of ER strategies considered less effective at reducing negative affect (i.e., suppression, rumination, and avoidance). When compared to individuals with other mental disorders, people with BPD endorsed higher rates of rumination and avoidance, and lower rates of problem solving and acceptance. We also review important contributions from studies of ER in BPD that we were unable to incorporate into our meta-analysis. We conclude by discussing how the pattern of using ER strategies in BPD contributes to emotion dysregulation and also the potential reasons for this pattern, integrating both Gross's extended process model of ER and Linehan's updated theoretical account on the development of emotion dysregulation.

Keywords: acceptance, avoidance, cognitive reappraisal, emotion dysregulation, problem solving, rumination, suppression

Borderline personality disorder (BPD) is a severe mental disorder resulting, in part, from a disturbance of the emotion-regulation (ER) system.[1] For this reason, *emotion dysregulation* is thought to be a core characteristic of BPD[2] and is one of the most widely studied dimensions in the disorder. Emotion dysregulation is increasingly thought to underlie the etiology and maintenance of many mental disorders, including depressive, anxiety, substance use, and eating disorders, and is increasingly being considered a transdiagnostic symptom dimension.[3–5] Despite increased attention in studying disturbances to the ER system within psychopathology, specific definitions of emotion dysregulation continue to remain elusive. Researchers have also adopted a wide variety of operational definitions of emotion dysregulation,[6,7] with intent to measure this dimension using self-report, behavioral, physiological, and neuroimaging methods.

Linehan[1] proposes that emotion dysregulation emerges as a result of both biological and social-learning processes during childhood and adolescent development. Some individuals are biologically predisposed to have an increased capacity to experience emotions, an intense reactivity to emotional events, and a delayed recovery to one's baseline level of emotional experience. The development of emotion dysregulation and BPD occurs when a biologically vulnerable individual experiences chronic disruption to the ER system over the course of childhood and early adolescence, and is typically exacerbated by external variables in the environment. These external factors may involve significant others who act in emotionally invalidating ways by responding erratically, insensitively, or inappropriately to an individual's expressions of emotion. Emotional invalidation can involve an emphasis on controlling emotional expressiveness, disapproval in the expression of negative affect, chronic peer rejection, emotional neglect, and abuse of many forms.[1] Emotional invalidation is thought to disrupt the development of the ER system, which normally involves children and adolescents learning to use more self-initiated versus other-initiated strategies, more cognitive rather than

behavioral strategies, and greater flexibility in strategy use, depending on the situation and emotion.[8] The maturation of ER is primarily achieved in childhood and adolescence through modeling significant others and their interactions with emotional stressors. However, adults who come from emotionally invalidating environments report more difficulties in labeling their emotions, modulating arousal, and tolerating negative emotions, and they also regulate their emotions in less effective and developmentally inappropriate ways.[9–13]

Some researchers studying emotion dysregulation in BPD measure aspects of emotional vulnerability, such as individuals' self-reported or physiological emotional reactivity to stimuli in the laboratory or in their natural environments (see Kuo & Linehan [2009],[14] Crowell et al. [2009],[15] and Ruocco & Carcone [2016][16]). Others have focused on studying the specific ER strategies that people with BPD use to regulate their emotions, as emotion dysregulation may stem from selecting and implementing less effective ER strategies.[17,18] People with BPD engage in a variety of self-destructive and harmful behaviors more often than individuals with other mental disorders,[19] including physical self-injury, alcohol and substance use, impulsive sexual behaviors, uncontrollable eating patterns (e.g., binging, purging), angry outbursts, dissociation (e.g., perceptual disturbances, watching oneself from outside the body), and social avoidance to reduce the likelihood of being emotionally triggered.[18] Studying the underlying reasons for the selection and implementation of less effective ER strategies in BPD is therefore especially warranted.

Since the 1990s, the *process model* of ER has emerged as a contemporary framework that organizes the various stages at which one can change emotional experiences; it has been extended to the study of mental disorders, including BPD.[20] According to this model, ER occurs when individuals implicitly or explicitly activate goals to change their emotional experiences, using strategies to achieve these goals and with outcomes specific to the individual, emotion, and context. Each stage of an emotional experience is treated as a potential target for ER strategies because an emotional situation can be selected, modified, attended to, appraised, and expected to produce a particular set of behavioral responses. Using this framework, many strategies can be considered forms of ER because they can be consciously or unconsciously selected and implemented to change emotional experiences in accordance with an individual's goals (e.g., to downregulate negative emotions). The model also appreciates that the use of ER strategies will have different consequences for different people, both immediate and long term. Given the centrality of disruptions to the ER system in BPD, the process model can be an especially helpful framework for emotion-dysregulation findings. Impulsive suicidal behaviors, which are highly maladaptive, as well as highly effective strategies[1] such as gaining access to hospital care, can be subsumed with the process model. The process model defines emotion dysregulation as a failure to engage in ER when it would be helpful to do so or using ER strategies that are a poor match to an individual's situation.[4] Accordingly, Linehan and colleagues[2] now define emotion dysregulation as an inability to change or regulate emotional cues, experiences, actions, verbal responses, or nonverbal expressions despite effortful attempts to do so.

In this review and meta-analysis, we considered six ER strategies that are commonly studied using the process model,[21] although one of the broader issues in studying ER is the sheer range of strategies and operational definitions for them (see Supplementary Text Box 1 for a summary of operational definitions, available at http://links.lww.com/HRP/A90). The six strategies chosen have a relatively large literature contributing to their definition(s) and have been considered in research on both ER and psychopathology. As used here:

– *Avoidance* is an umbrella term referring to an unwillingness to experience negative emotions along with related physical sensations and thoughts. This strategy is enacted early, given that one could physically avoid negative or undesirable emotions before entering the situation itself. More broadly, avoidance can encompass the suppression or avoidance of an array of psychological experiences such as thoughts, emotions, sensations, memories, and urges (i.e., experiential avoidance).[36] Similarly, other researchers may measure distress tolerance as an unwillingness to experience emotional distress in order to pursue goal-directed behavior.[52]

– *Suppression* refers either to attempts to decrease the expression of an emotional response (i.e., expressive suppression)[20] or to conscious and effortful attempts to reduce or distract oneself from thoughts and feelings that are believed to be unhelpful or undesirable (i.e., thought suppression).[22]

– *Rumination* refers to repetitive thinking of the causes and consequences of emotional experiences, and prevents active problem solving to change circumstances surrounding these symptoms.[28] However, given that rumination is also highly correlated with worry—defined as a chain of thoughts, images, and emotions in a repetitive uncontrollable manner[29]—and may actually be part of the same multifaceted construct as rumination,[53] we considered these strategies under one umbrella term related to maladaptive repetitive thought.

– *Cognitive reappraisal* involves generating benign or positive reinterpretations or perspectives of a stressful situation as a way of reducing stress and is an ER strategy employed at the appraisal level in the process model.[20]

– *Mindfulness* and *acceptance* are overlapping terms used to describe two beneficial processes: present-moment awareness and nonjudgmental acceptance of feelings and emotional states.[47] We chose to subsume the two related processes under the term *acceptance* as a way to measure people's ability to work with, rather than reject, emotional experiences.

– *Problem solving* involves both a metacognitive process in generating potential effective solutions, and attempts to discover effective solutions or ways of coping with problem situations.[44] Although problem-solving responses may not

reflect direct attempts to regulate emotions, they can precede the use of other strategies by modifying or eliminating stressors before they escalate. Moreover, poor problem-solving skills have been found to relate to multiple mental disorders, with problem-solving skill building sometimes a major component of interventions for these conditions.[21]

These six ER strategies have different associations with symptoms of psychopathology in the long term and may differ with respect to benefits and consequences in the short term. Suppression, rumination, and avoidance are considered *ineffective* strategies because they are associated with costs that outweigh the benefits of short-term reduction in acute emotion, such as increased physiological responses and rebounds in the intensity of the affect intended to be regulated.[28,54–59] Higher endorsements of suppression, avoidance, and rumination also predispose individuals to experience higher symptoms of psychopathology, particularly depressive and anxiety disorders.[21] Meanwhile, cognitive reappraisal, acceptance, and problem solving are considered *effective* ER strategies and are associated with more favorable outcomes such as reduced physiological arousal, increased pain tolerance, greater memory encoding, and greater symptom reduction in psychotherapy in the short term.[54,55,60–62] Additionally, more-effective strategies are associated with better long-term health outcomes, higher relationship quality, academic achievement, and work performance.[23,63,64] Research has already suggested that individuals with BPD have difficulty implementing effective ER strategies and rely on more typically ineffective strategies such as avoidance, rumination, and suppression to deal with emotional stressors.[17,65–67]

CURRENT META-ANALYSIS AND REVIEW

In this meta-analysis and review, we systematically reviewed six of the most commonly studied ER strategies and determined their relative endorsement in individuals with elevated symptoms of BPD compared to individuals with low symptoms of BPD and healthy controls. We expected that symptoms of BPD, assessed in a variety of clinically interviewed and nonclinical samples, would be associated with less frequent use of ER strategies that would be considered more effective at reducing negative affect (cognitive reappraisal, problem solving, and acceptance) and more frequent use of ER strategies considered less effective (suppression, rumination, and avoidance). In an effort to understand whether the selection of more ineffective and less effective ER strategies was specific to BPD compared to other mental disorders, we also examined the specificity of these findings in BPD. Given the centrality of emotion dysregulation in BPD, we expected that this problematic pattern of ER strategies would be significantly more prominent in BPD than in other mental disorders. We conclude by discussing potential reasons for this pattern of ER strategies, using both the process model of ER and biosocial theories in the development of emotion dysregulation.

METHOD

Literature Search

A systematic literature search was conducted using PsycInfo (ProQuest) and PubMed databases on 2 June 2014 and updated on 20 December 2016. We later removed all articles previous to 1987, corresponding with a significant revision of the BPD diagnostic criteria in the *Diagnostic and Statistical Manual of Mental Disorders*, third revised edition.[68] The following search terms were used in various combinations: borderline personality disorder, BPD, emotion regulation, emotion dysregulation, affect regulation, affect dysregulation, disengagement, distraction, mindfulness, acceptance, problem solving, social problem solving, self-criticism, blame, rumination, worry, avoidance, experiential avoidance, coping, reappraisal, appraisal, interpretation, situation, attention, self-regulation, up-regulation, and down-regulation. We also searched for truncated versions of these terms and identified additional articles through searching the reference lists included articles. The literature search relied on identifying search terms through title, abstract, and article keywords; it is therefore possible that studies investigating ER strategies in BPD were not identified when search terms were not described in those fields.

Inclusion and Exclusion Criteria

Studies included in the meta-analysis either (1) quantitatively analyzed at least one self-report cross-sectional relationship between a target cognitive ER strategy and a dimensional measure of BPD symptoms, or (2) reported at least one self-report group difference between individuals with BPD and another group (e.g., healthy individuals or another mental disorder) with respect to the target cognitive ER strategies. In some cases, quantitative data from studies could not easily be extracted because of the particular methods employed (e.g., behavioral tasks or experience sampling) but were added to the narrative section of this review if they explored the relationship between BPD and an ER strategy of interest. Studies were included whether children, adolescents, or adults were studied, and the samples came from various demographic settings, such as schools, community-based cohorts, outpatient psychiatric treatment programs, and psychiatric inpatient settings. Only articles written in English were included in the review. Both ER strategies and BPD symptoms were most often assessed via self-report questionnaires, but the latter was also frequently assessed using diagnostic interviews. A number of studies provided self-report data on more than one relationship between regulation strategy and BPD (e.g., two self-report measures or different subscales of the same measure that measured different ER strategies). These quantitative data were considered independently within the meta-analysis while avoiding the duplication of sample demographics (see Aldao et al. [2010][21] for similar methodology).

The following exclusion criteria were applied: (1) non-peer-reviewed materials, including dissertations, master's

theses, reviews, book chapters, and conference presentations; (2) studies involving special populations such as individuals with medical conditions and comorbid BPD (e.g., cancer and BPD) or other groups associated with BPD (e.g., caregivers of individuals with BPD); (3) treatment studies of individuals with BPD, unless they provided a baseline comparison to another group (e.g., healthy individuals); (4) neuroimaging and physiological studies involving individuals with BPD, unless they included a self-report measure involving a particular ER strategy; and (5) studies in which observer or informant ratings of ER abilities were made. To further streamline this review, we did not consider strategies such as dissociation or defense mechanisms, and several strategies from the coping literature (e.g., self-criticism, self-blame, religiosity, and self-compassion). In addition, we chose not to review the extensive literature on harmful behaviors to regulate emotions.

Search Results and Meta-analysis
As seen in Supplemental Figure 1 (available at http://links. lww.com/HRP/A88), research assistants reviewed the titles and abstracts from a subset of the results to remove listings that were unlikely to meet inclusion criteria for the present study. The authors then assessed the remaining articles for eligibility according to the inclusion criteria using full-text article searches. Positive results (n = 179) were submitted for further consideration and were then independently rated for inclusion, with substantial levels of agreement (κ = .68). The remaining 93 studies (after excluding 66 studies) were included in the meta-analysis, with 20 additional studies of interest incorporated into the discussion of the findings.

In our results, we refer to associations with BPD symptoms—a necessary adjustment given that samples did not always include individuals with categorical diagnoses of BPD. Hence, the meta-analytic results consist either of zero-order correlations between BPD symptoms and ER strategies or of group differences between BPD groups and healthy controls or nonclinical comparison groups. Fewer studies compared categorically defined BPD groups with other mental disorders; we therefore combined these analyses so that BPD was compared to all other mental disorders. Moderator variables extracted from each article included the mean age of participants, percentage female, sample type (college, community, outpatient, or inpatient), and self-report measure. When organizing quantitative data, if a study provided several subscales for the same strategy, the scores were averaged to yield a single score that was included only once in the meta-analysis. Scores were reversed-coded, as needed, to indicate more frequent use of each strategy as positive, and vice versa for negative scores. If a study provided both continuous and dichotomous between-groups comparisons, we opted to include the continuous data because they minimize a loss of information and decrease the probability of type II errors.[69] To organize data and calculate effect-size statistics for each ER strategy, Comprehensive Meta-analysis (CMA) 3.0 was used. With this software program, a variety of statistical tests, including

Pearson correlations, raw means and standard deviations, and t- and F-test statistics could be readily converted. In a few instances, beta coefficients were converted to standardized raw differences using a procedure described previously.[70] Effect-size statistics were analyzed using random-effect models with Pearson coefficients (r) used as our statistical output to ease interpretation. Cohen's guidelines[71] for interpreting correlation effect sizes consider rs $\geq$ .10 as small, rs $\geq$ .30 as medium, and rs $\geq$ .50 as large. Moderation analyses were completed using IBM SPSS 23.0, weighted for sample size.

RESULTS

Meta-analytic Results of ER Strategies in BPD
Based on aggregated results from 59 studies, higher endorsements of suppression, rumination, and avoidance were significantly associated with higher BPD symptoms (Table 1). Higher BPD symptoms were also associated with significantly lower endorsements of cognitive reappraisal, problem solving, and acceptance, based on results from 71 studies. When individuals with BPD were compared to individuals with other mental disorders, individuals with BPD reported higher endorsements of rumination and avoidance, and significantly lower endorsements of problem solving and acceptance (see Supplementary Tables S1–S6 for detailed results for each study available at http://links.lww.com/HRP/A89,[72–158] including many not already cited). Differences between BPD and other mental disorders were not significant with respect to endorsements of suppression and cognitive reappraisal, with results being more mixed with regard to directionality. Some BPD samples tended to report higher endorsements of suppression compared to individuals with other mental disorders, while other samples endorsed suppression less often. Most studies on cognitive reappraisal supported lower endorsements in individuals with BPD, except for two studies in which individuals with BPD were found to use reappraisal slightly more often than individuals with major depressive disorder (MDD).

Moderation analyses for self-report measure, sample type, mean age, and percentage female were nonsignificant for suppression, avoidance, cognitive reappraisal, and problem solving (Fs < 3.14, ps > .07; |r|s < .38, ps > .15). For rumination and acceptance, there were significant differences in effect size according to the self-report measure employed (Fs > 3.34, ps < .03) but not with respect to other moderators (Fs < 2.12, ps > .12; |r|s < .28, ps > .13). Studies employing the Anger Rumination Scale (n = 11) produced larger effect sizes on average than the Cognitive Emotion Regulation Questionnaire (n = 5), with no other significant differences among studies employing the Rumination and Reflection Questionnaire/ Ruminative Response Scale (similar versions of the same scale: n = 10) or other rumination scales (n = 6). Studies using the Difficulties in Regulating Emotions Scale nonacceptance subscale (n = 19) produced larger effect sizes in comparison to our grouping of "other" scales measuring acceptance-related strategies (p = .005; n = 9), and there were no differences between

Table 1

Meta-analytic Statistics for Individuals with BPD Compared to Other Groups for Each Emotion-Regulation Strategy

Strategy	Comparison	Unique studies (n)	Effect size (r)	95% CI (lower)	95% CI (upper)	Z	p	k statistics	Q-statistic p-value
Suppression	BPD/high BPD vs. NCCs/low BPD	19	.351	.286	.413	9.967	<.001	25	<.001
	BPD vs. other mental disorders[a]	6	.029	−.074	.131	.548	.584	7	.089
Rumination	BPD/high BPD vs. NCCs/low BPD	23	.526	.480	.569	18.570	<.001	32	<.001
	BPD vs. other mental disorders[b]	6	.217	.142	.290	5.553	<.001	7	.655
Avoidance	BPD/high BPD vs. NCCs/low BPD	17	.449	.339	.547	7.267	<.001	20	<.001
	BPD vs. other mental disorders[c]	4	.516	.262	.703	3.698	<.001	4	<.001
Cognitive reappraisal	BPD/high BPD vs. NCCs/low BPD	18	−.273	−.342	−.201	−7.209	<.001	19	<.001
	BPD vs. other mental disorders[d]	13	−.227	−.517	.110	−1.327	.184	14	<.001
Problem solving	BPD/high BPD vs. NCCs/low BPD	17	−.257	−.323	−.189	−7.162	<.001	21	<.001
	BPD vs. other mental disorders[e]	10	−.388	−.583	−.189	−3.082	.002	11	<.001
Acceptance	BPD/high BPD vs. NCCs/low BPD	36	−.470	−.529	−.406	−12.627	<.001	42	<.001
	BPD vs. other mental disorders[f]	8	−.178	−.275	−.078	−3.470	<.001	11	.027

Note: Unique studies (denoted by "n") sometimes contributed two or more statistics (denoted by "k") to the meta-analyses. Hence, we described each statistical comparison between BPD and other psychiatric groups in more detail using k.

[a] MDD (k = 3), eating disorders (k = 2), mixed disorder sample (k = 1), obsessive-compulsive disorder (k = 1).

[b] MDD (k = 3), bipolar disorders (k = 2), other personality disorders (k = 1), mixed disorder sample (k = 1).

[c] Social anxiety disorder (k = 2), substance dependence (k = 1), mixed disorder sample (k = 1).

[d] Mixed disorder sample (k = 4), MDD (k = 3), bipolar disorders (k = 2), other personality disorders (k = 1), eating disorders (k = 1), trauma-exposed individuals (k = 1).

[e] Mixed disorder sample (k = 4), MDD (k = 2), bipolar disorders (k = 2), substance dependence (k = 1), bulimia nervosa (k = 1).

[f] Bipolar disorders (k = 3), mixed disorder sample (k = 1), social anxiety disorder (k = 1), obsessive-compulsive disorder (k = 1), bulimia nervosa (k = 1).

BPD, borderline personality disorder; CI, confidence interval; MDD, major depressive disorder; NCC, nonclinical comparison group.

Difficulties in Regulating Emotions Scale nonacceptance when compared to the Five Facet Mindfulness Questionnaire (n = 9) or Mindfulness Attention Awareness Scale (n = 5).

The influence of publication bias was assessed by creating funnel plots for each meta-analytic statistic (i.e., standard error vs. standardized Fisher Z correlation coefficients) and then subjecting the values to a t-test for asymmetry. As depicted in Figure 1, two plots were made, one for comparisons between BPD (or high BPD symptoms) and nonclinical controls (or low BPD symptoms; $k_{statistics} = 159$) and one for data obtained from studies that compared BPD to other mental disorders ($k_{statistics} = 54$). Tests for asymmetry were not statistically significant for both funnel plots ($|t|$s < 1.49, ps > .14),

indicating a low probability that publication bias affected the results.

Additional Findings Pertaining to ER Strategy Use

SUPPRESSION Several studies demonstrate that people with BPD may actually benefit from using suppression—at least in the short term. Using experience sampling, instructions to suppress were associated with higher positive emotions and lower urges to engage in impulsive behaviors among individuals with high trait-BPD versus low trait-BPD,[118] which was the opposite of expectations. This finding has now been replicated several times by different researchers.[159,160] In one study, BPD individuals instructed to use expressive suppression
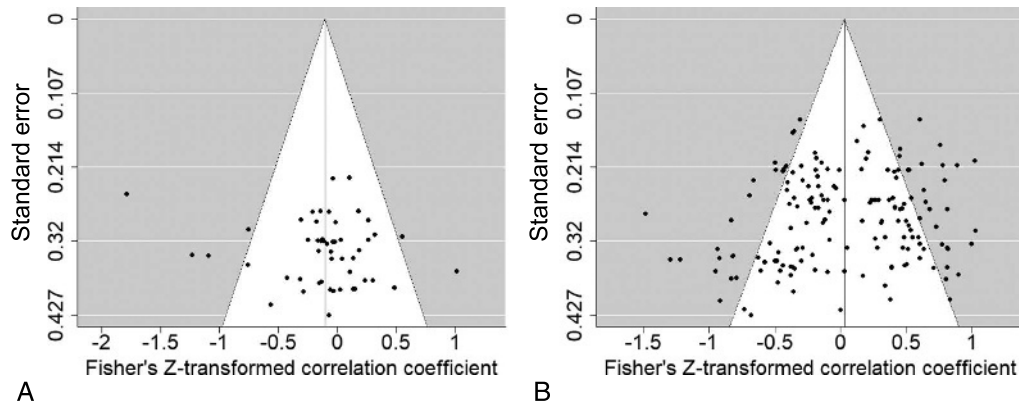
Figure 1. Funnel plots used to visually inspect whether publication bias may have affected the meta-analysis. We present separate plots of (A) data obtained from studies with comparisons between BPD (or high BPD symptoms) and nonclinical controls (or low BPD symptoms), and (B) data obtained from studies that compared BPD to other mental disorders. BPD, borderline personality disorder.

did not experience an increase in the urge to engage in self-injury after watching a negative film (which did occur when different BPD participants used acceptance).[160] Five minutes after the negative film clip, the BPD group instructed to use expressive suppression reported a decrease in the urge to engage in self-injury. In another study, BPD individuals who were instructed to suppress unwanted thoughts were able to reduce their subjective distress but exhibited increased thought intrusions during the instruction period as well as more attempts to distract themselves in a second phase of the task.[159] These results highlight the potential short-term benefits related to reduced physiological arousal and emotional distress, which may underlie higher suppression use in BPD.

RUMINATION For BPD individuals, using rumination in conjunction with higher negative affect and lower emotion differentiation puts them at greater risk of engaging in harmful behaviors.[97,98] Rumination is higher in BPD than in community individuals who endorse engaging in harmful dysregulated behaviors.[97] Associations between rumination and BPD remain significant even when controlling for the negative thinking styles that are common in depression.[161] Symptoms of affective instability appear more strongly associated with depressive rumination in BPD, while difficulties in interpersonal relationships appear more strongly related to anger rumination.[94] Anger rumination is also a significant mediator between indices of childhood precursors to BPD (i.e., emotional vulnerabilities) and self-reported severity of BPD in undergraduate students.[96] Higher BPD severity one year following psychotherapy was associated with higher self-reported anger rumination at baseline.[103] One study induced both anger and depressive rumination using an experimental mood-induction procedure in undergraduate students.[162] Compared to the low trait-BPD group, the high trait-BPD group reported higher negative affect and higher negative self-conscious experiences for both inductions. These results suggest that high trait-BPD individuals may be more vulnerable to self-blame and self-criticism when engaging in rumination, potentially intensifying emotional cascades and increasing the risk of engaging in harmful behaviors.[67]

AVOIDANCE The association between experiential avoidance and BPD remains significant even after controlling for negative affect,[78] depression,[122] and general difficulties in ER.[126] When several scales measuring experiential avoidance were combined, results also supported relationships between higher experiential avoidance and higher BPD symptom severity in research with incarcerated females.[38,163] Importantly, higher endorsements of avoidant coping were associated with a greater number of suicide attempts and episodes of self-injury, and also with higher lethality ratings of self-injury, in a sample of diagnosed BPD females.[140] Endorsements of situational avoidance were a unique predictor of BPD symptom severity in undergraduates,[86] while an observational study found that individuals with BPD were almost four times more likely than healthy controls to avoid sitting in a waiting room chair facing a mirror.[164] Individuals with BPD terminate distress-tolerance tasks significantly earlier than healthy individuals and those with other mental disorders.[52,151,165] Participants with co-occurring BPD and avoidant personality disorder terminated a distress-tolerance task even faster than those with BPD alone.[151] Low distress tolerance and the presence of BPD are also associated with higher lifetime suicide attempts in samples of substance-dependent females,[165,166] suggesting that people with BPD are more likely to use impulsive efforts to regulate their moods rather than to endure them. One experience-sampling study found that people with BPD, but not those with MDD or healthy controls, reported reductions in negative affect and urges to engage in harmful behaviors when given instructions to use avoidance.[167] A mood-induction study found mixed benefits in the use of experiential avoidance following a negative video clip in a community sample with varied BPD symptoms.[84] Following the negative mood induction, high-trait BPD symptoms and high experiential avoidance were related to higher positive affect, but also higher sympathetic activity and slower recovery with respect to negative affect. Similar to suppression, studies suggest potential short-term physiological and emotional benefits in avoiding the experience of negative emotions for those with elevated BPD symptoms.

COGNITIVE REAPPRAISAL When individuals with BPD are instructed to use different types of cognitive reappraisal tactics, they do not appear to differ from healthy controls in reducing negative affect,[168–170] suggesting that they are able to generate effective reinterpretations. One other study investigated whether groups of BPD, MDD, and healthy individuals differed in their choice of ER strategy (cognitive reappraisal versus distraction) in response to low-intensity and high-intensity negative images.[111] Overall, participants from the three groups displayed no differences from each other in the rates at which they chose reappraisal for high- and low-intensity images. Reappraisal was chosen more often for low-intensity images, and distraction more often for high-intensity images. Those with higher BPD severity, however, endorsed distraction proportionately more often than cognitive reappraisal. No experience-sampling studies have investigated the potential benefits or consequences of using cognitive reappraisal in BPD individuals.

PROBLEM SOLVING Within BPD, difficulties in problem solving are a predictor of a greater number of self-injury and suicidal episodes, as well as increased severity of self-injury.[133,140] Higher self-reported BPD symptoms are also associated with responses to "arguing with others" (an ineffective strategy) but not "problem solving" or "seeking advice."[86] Problem-solving difficulties in BPD did not appear to be related to depressive symptoms, according to one study.[134] Research suggests that individuals with BPD use problem solving less often, with some evidence of adverse consequences, such as turning to strategies such as nonsuicidal self-injury and arguing with others. Deficits in problem solving have important and serious consequences; research demonstrates higher associations with impulsive, harmful behaviors such as self-injury, suicidal gestures and threats, and suicide attempts.[171]

ACCEPTANCE Reduced acceptance and mindfulness in BPD individuals is associated with higher rates of self-injury and medical office visits and with poorer emotional well-being, social support, and general health.[152,172] Several studies found evidence, however, that individuals with BPD can implement acceptance and mindfulness techniques when instructed.[173–175] One study showed evidence of skill strengthening when individuals with BPD were instructed to use mindful awareness, suggesting that they had more to gain than healthy individuals from learning this strategy.[173] Using a behavioral task to assess mindfulness, BPD individuals were found to be less frequently mindful than healthy individuals, but they also detected their difficulty in staying mindful with higher accuracy (i.e., they appear aware of themselves being less mindful).[176] Differential effects in using acceptance in BPD exist compared to the effects for healthy individuals. One experimental laboratory study found that instructions to BPD individuals to accept emotions in response to negative films were associated with an increase in urges to self-injury compared to BPD individuals who were instructed to suppress emotions.[160] Five minutes after negative

mood induction, BPD participants instructed to suppress reported a decrease in the urge to self-injury, whereas those in the acceptance condition did not. Another laboratory study reported unique increases in heart rate variability among BPD participants instructed to use acceptance compared to both MDD and healthy participants, whereas suppression instructions decreased heart rate variability.[177] The authors suggest that increased heart rate variability may reflect an increased ER effort by the BPD group. An experience-sampling study found that instructions to accept emotions were associated with increased urges to engage in harmful behaviors in BPD individuals compared to MDD and healthy participants.[167] In a study with low- and high-trait BPD participants, no clear evidence emerged that employing acceptance was particularly adaptive for regulating negative mood after watching negative film clips.[84] Finally, some evidence suggests that instructing individuals to engage in mindfulness during a distress-tolerance procedure, compared to instructions to ruminate, allows BPD individuals to persist longer on a laboratory task.[175] Another study of BPD patients found that those instructed to engage in acceptance reported higher levels of subjective distress despite fewer intrusive thoughts, compared to another group of BPD patients instructed to engage in suppression.[159] Studies collectively suggest that acceptance may be associated with reduced affective benefits for individuals with BPD.

DISCUSSION

Using meta-analytic techniques focusing on six commonly studied ER strategies, we confirmed our hypothesis regarding significantly higher use of typically ineffective ER strategies (e.g., suppression, rumination, avoidance) in individuals with elevated BPD symptoms, compared to healthy individuals and those with low BPD symptoms. We also found that individuals with elevated BPD symptoms endorsed significantly lower use of more effective long-term ER strategies (e.g., cognitive reappraisal, problem solving, acceptance) compared to healthy individuals and those with low BPD symptoms. The specificity of these results was also explored using comparisons of BPD to other mental disorders for which data were available. Significantly higher endorsements of ineffective strategies were found in BPD compared to other mental disorders for rumination and avoidance, whereas lower endorsements of effective ER strategies were found for problem solving and acceptance. Results suggest a difficulty in selecting more effective ER strategies over ineffective ones in BPD, potentially limiting the success of ER attempts in the short term and maintaining emotion dysregulation in the long term. Importantly, our results were not able to confirm the directionality of these effects. It is possible that ER strategies influence the development of BPD and vice versa; or there might be bidirectional effects that influence the relationships between ER strategies and BPD over time.

Additional findings from our literature search also illustrate the potential connections between the use of harmful behaviors and the pattern of cognitive ER strategy endorsed by

individuals with BPD. Collectively, people with BPD are more likely to continue experiencing negative emotions, distressing symptoms, and heightened physiological arousal, and are at greater risk of engaging in harmful behaviors because of their higher use of ineffective ER strategies. Moreover, the protective long-term benefits of using more effective ER strategies are diminished, including reductions in sympathetic nervous system arousal, fewer negative emotions and moods, and better physical and mental health outcomes. Research even suggests that frequent utilization of effective ER strategies can mitigate the consequences of using ineffective ones.[178] Individuals with BPD therefore appear to use ER strategies that are poorly matched to long-term goals of reducing negative emotions and that resolve negative emotions only temporarily and in the short term—which supports the process-model definition of emotion dysregulation. In addition, several studies indicate that individuals with BPD may benefit from using ineffective ER strategies (i.e., suppression and avoidance) in the short term, whereas there are some negative short-term consequences to using relatively more effective ones (e.g., acceptance).

Potential Reasons for ER Difficulties in BPD

EMOTIONAL AWARENESS AND ACTIVATION OF ER GOALS The process model highlights emotional awareness as an integral feature of successful ER, serving to enhance both the range and flexibility in the use of ER strategies.[4] Low emotional awareness, however, is commonly reported in BPD[179,180] and can disrupt the ability to distinguish emotions, reducing the likelihood of selecting ER strategies appropriate to each emotion. Reduced emotional awareness in BPD may coalesce as the result of disruptions to the normal development of ER. Significant relationships have been reported between features of invalidating environments and difficulties in labeling emotional states and in expressing negative emotions to others.[9–13] Reduced emotional awareness, which hinders the formulation of clear goals, may put BPD individuals at reduced likelihood of engaging in ER when it might be helpful to do so.

IMPLICIT BELIEFS ABOUT EMOTIONS AND THEIR MALLEABILITY Beliefs that one has low regulatory self-efficacy may influence attempts at particular ER strategies.[181] Given the tendency to more often use experiential avoidance and nonacceptance in BPD, these individuals may be reinforcing the ideas that negative emotions are intolerable and need to be eliminated as quickly as possible, leading to greater ineffective ER strategy use.[38,52,117,182] Beliefs that emotions are unchangeable also tend to reduce ER success compared to what happens when people believe emotions can be modulated.[183,184] Reduced ER success may stem from more weakly activated goals to engage in ER in conjunction with these types of beliefs, even when an emotion that would benefit from regulation is detected.[4] Alternatively, compared to healthy individuals, people with BPD may have a higher threshold to activate goals to engage in ER, stemming from learning experiences and

an overvaluation of controlling or suppressing emotions.[1] A higher threshold to activate ER goals may result in *delayed* implementation of ER strategies and may leave individuals with BPD responding to emotional experiences after the event occurs rather than during it.

BIASED PERCEPTIONS OF ER STRATEGIES Studies of BPD that incorporate the Difficulties in Regulating Emotions Scale[51] show elevations on the perceived lack of access to ER strategies subscale, compared to healthy individuals and those with other mental disorders.[76,81,100,151,153,154] This perception may relate to a sense of learned helplessness or diminished regulatory self-efficacy in BPD, in which they feel they are less likely to be successful in regulating their emotions.[185] Supporting this assertion, individuals with BPD perceived themselves as being less successful at using cognitive reappraisal tactics even when no behavioral differences in performance were evident.[169,170] People with BPD may also overvalue ineffective ER strategies that favor short-term benefits over long-term goals for emotional stability. For example, avoidance of stressful social situations reduces unpleasant emotions quickly but does not consider the long-term implications (e.g., social isolation) of employing the strategy repeatedly. One study reported that people with high trait-BPD perceived more functional ER strategies as less effective.[186] The problem is compounded by the affective instability and impulsivity experienced by individuals with BPD,[15] meaning that a higher number of situations will likely be appraised as stressful and undesirable. Over time, individuals with BPD may use ineffective ER strategies because they provide short-term relief from chronic negative affective experiences. Similarly, attempting to accept negative emotional experiences may be perceived as less desirable and less tolerable for individuals with BPD, who often experience emotions more intensely. Ultimately, the tendency to use effective ER strategies is reduced when biased beliefs concerning their effectiveness are incorporated into one's behavior.

BIASED ATTENTION TOWARD CONTEXTUAL INFORMATION At the selection stage, ER strategies are identified and evaluated for implementation based on contextual factors of the situation.[4] This may be another issue in BPD, given that they tend to attribute negative information to neutral facial expressions[187] and interpersonal situations.[188] They also display heightened sensitivity to threat cues, inferring that others are hostile, distrustful, or invalidating,[189,190] and they evaluate themselves as vulnerable, bad, helpless, or inadequate.[65] Moreover, the available evidence suggests the presence of negative attentional bias in BPD for generally negative and BPD-specific negative stimuli compared to healthy individuals (see review by Kaiser et al. [2016][191]), in addition to a difficulty disengaging attentional resources from negative stimuli.[192] Biased attention toward negative stimuli could translate into increased ruminative focus in lieu of cognitive action. The cognitive and attentional biases in BPD are supported by evidence of neurobiological

alterations in the structure and functioning of brain regions involved in the subjective experience of emotions (e.g., amygdala, insular cortex) and the regulation of emotions (e.g., prefrontal cortex, anterior cingulate cortex).[16] If negative experiences are more commonly attended to by those with BPD, it is possible that neurobiological mechanisms underlying ER may be overwhelmed by high demands for such processes or are more generally underrecruited, leading to difficulties in engaging more effective ER strategies.

PHYSIOLOGICAL REACTIVITY Increased physiological reactivity to emotional situations may reduce the selection and implementation of more effective ER strategies *during* the emotional event (see review by Beauchaine [2015][193]). Most individuals—including those with MDD, BPD, and high trait-BPD—favor distraction over cognitive reappraisal for high- versus low-intensity negative stimuli because of reduced cognitive demands; however, physiological measures were not assessed in conjunction with this relationship.[111,194,195] People may differ outside the laboratory when encountering more dynamic or spontaneous emotional stimuli. Research supports the relationship between parasympathetic nervous system functioning and the diminished capacity to respond to emotional stressors (i.e., emotion dysregulation). Measures of respiratory sinus arrhythmia (RSA) are often used because it reflects both prefrontal cortex functioning (via vagal nerve innervation) and therefore also the capacity to engage flexibly in ER.[193] Studies have suggested that abnormally low resting-state RSA and high RSA reactivity during emotional provocation are associated with various forms of psychopathology.[193,196] Low resting-state RSA has been found in BPD compared to healthy controls;[197] however, results for RSA reactivity in BPD were more mixed. Some studies report heightened physiological reactivity to negative mood induction, and some report no differences between comparison groups.[197,198] Lower RSA reactivity tends to be associated with more adaptive responses following mood induction.[199] Given the relationship between physiological measures, ER, and emotion dysregulation, further research in this area is warranted.

ACTUAL IMPLEMENTATION OF ER STRATEGIES Fewer successful attempts at implementing ER strategies may relate to perceived lack of skill in translating a given strategy into the situation.[4] Chapman and colleagues[167] suggest that learning to use acceptance-based strategies in BPD may require more practice time to understand the benefits for emotional functioning. Research has found that people with BPD also make more attempts to regulate their emotions and endorse a mix of both effective and ineffective strategies during ER,[83,186,198] potentially limiting the effectiveness of a single strategy. In one mood-induction study, individuals with BPD continued to report higher negative mood than healthy controls despite endorsing, on average, a higher number of ER strategies to regulate their emotions.[198] Increased attempts at ER may be

the result of depleted cognitive resources that leave individuals implementing suboptimal strategies and, in turn, more vulnerable to subsequent stressors.[17,83] Moreover, several studies indicate that people with BPD can implement effective ER strategies (i.e., acceptance, cognitive reappraisal) when instructed to do so in the laboratory.[111,160,168–170,173–175,200] It is possible, however, that people with BPD are less persistent in applying effective ER strategies over time, although research has not investigated this hypothesis. People with BPD may also perseverate on their previous actions and inflexibly respond to different situations with the same ineffective strategies (or no ER strategy at all), even when it may not be effective or appropriate.[201]

In summary, many potential factors contribute to difficulties in ER strategy selection and implementation in BPD. These factors integrate developmental, biological, and affective-science perspectives that parallel the complex relationship of precursors involved in the development of BPD outlined by the biosocial theory. The results support and extend the biosocial theory in two main ways. First, our results support a serious ER disturbance in BPD that contributes to emotion dysregulation and to symptoms of the disorder. This disturbance can help to explain why individuals with BPD may use harmful regulatory behaviors (e.g., self-injury) as a consequence of a disturbed ER system. Second, our results support the interplay between developmental and biological factors in the development of BPD. Given that emotional vulnerabilities increase the risk of BPD and that ER strategies are learned over the course of childhood and adolescence, the relative use of more ineffective rather than effective ER strategies may coalesce as emotion dysregulation across development, the result of an interplay of the two factors. More recent revisions of the biosocial model also consider neurobiological components that continue to support negative associations between BPD and learning healthy ER strategies in childhood and adolescence.[15]

Potential Clinical Implications

Results from this meta-analysis and review suggest that interventions that actively promote the practice and habitual use of adaptive ER strategies may reduce the severity of emotion dysregulation in individuals with BPD. Beliefs about abilities to effectively change emotions can be improved by having the client practice different ER strategies, with careful attention to the introduction of new strategies with clients. Most therapeutic orientations are focused on teaching clients new skills for coping—with some intervention doing so more explicitly than others. For example, the revised manual for dialectical behavior therapy contains extensive homework assignments detailing multiple ways of trying different mindfulness-based strategies.[1] Therapists could also seek information on the types of ER strategies that their clients typically use, with discussion on how the client feels about introducing or substituting old strategies for new ones. Discussing the pros and cons of different strategies may prove effective when coupled with

an examination of the short- and long-term effects, given that clients may not have considered the latter.

Behavior chain analysis is one technique that can help unpack an undesirable strategy (e.g., an incident of self-injury or argument) and generate multiple alternative solution strategies that a client could potentially use before escalating to the undesired outcome (e.g., to avoid being alone, to ask a friend for support, or to practice skills). Additionally, logging information about emotions and even physiological reactions that accompany certain types of strategies—including the location and context of the situation in which the strategy was used—may be helpful to discuss in session. Examining these factors may lead to fruitful discussions about alternative strategies that might be available in different contexts (e.g., when feeling sad vs. angry; when at home vs. work; when alone vs. with others). It is also possible that therapists may uncover some of the adaptive ER strategies that clients with BPD *are* using to deal with their emotional experiences, which can then be used to scaffold new techniques. Such exercises and discussions could promote the habitual use of more effective ER strategies to replace ineffective ones.

Therapists may encounter resistance with clients when introducing new strategies, given the substantial effort that may be involved in unlearning old strategies. Habitual ER strategies are often functional and effective for idiosyncratic reasons; therapists should uncover why clients hold onto those strategies so rigidly. If therapists encounter resistance, they could focus on improving emotional awareness with their clients, which may indirectly help individuals with BPD select more appropriate strategies. Most interventions also feature cognitive work that can help clients confront biases and beliefs about how they view themselves, others, and the world. By bringing into awareness these dispositional views, therapy may reduce the tendency to engage in certain ER strategies and may broaden the ways in which clients respond to distressing situations. Finally, therapists can help BPD clients counteract distressing physiological arousal that might lead them to implement less effective ER strategies. Simple strategies such as deep diaphragmatic breathing and grounding exercises can be effective in counteracting the physiological effects of acute distress in the moment, while reducing attentional focus on the distressing situation itself. These strategies may also be useful when implementing new ER strategies for the first time, when the effects of their use may not yet have displayed their full potential.

Limitations of the Current Meta-analysis and Review

Studies measuring dimensional symptoms of BPD and clinically assessed participants were both included in our meta-analytic analyses, which may have reduced the internal validity of our meta-analysis (i.e., ability to control for confounds). Notably, we used this method to capture a full range of relationships between our target disorder and ER strategies, in line with a different meta-analysis.[21] Moreover, we identified some significant relationships between BPD symptoms and ER strategies. These relationships may not generalize to all individuals with the disorder, however, given that results were obtained from both clinical and nonclinical settings. We were able to compare BPD only with "other mental disorders," given that there were markedly fewer studies that recruited additional participants other than BPD and healthy controls. We were not able to adequately consider several moderators important in research on ER strategies and BPD (e.g., comorbid diagnoses, BPD symptom severity, and treatment history). Almost all of the meta-analytic data in the present study came from self-report measures, which can be biased with regard to participants' recall.[202] Moreover, we summarized the relationships between BPD symptoms and ER strategies using many different self-report measures that purportedly measure the same construct. The exact construct measured by each scale and subscale may differ, which could affect the meta-analytic statistics. While we attempted to address this concern by including the self-report scale as a moderator in our analyses, there are ongoing debates about certain strategies and their operational definitions and separateness (e.g., mindfulness[203]). We also combined effect sizes across self-report measures and state measures of ER (e.g., reports of ER strategies following mood induction). Although we did not examine the potential moderating effects of state versus self-reported use of ER strategies, this distinction may be important since some studies find differences using state measures of ER strategies compared to traditional self-report measures (and vice versa).

More broadly, this review relied on grouping strategies into effective and ineffective categories. More recent work suggests that it is important to consider the context in which an ER strategy is used, with particular attention to the flexible use of ER strategies.[204,205] Future research could consider the flexibility with which ER strategies are used in BPD and examine the contextual factors that might influence the use of particular cognitive ER strategies (i.e., where and when). Another important limitation is that self-report measures do not assess the effectiveness of implementing an ER strategy or whether participants actually employ the strategy. Future research should consider these variables, given that people's knowledge about their ER efforts may not always be conscious.[206] Future research could also measure ER strategy use in BPD and other mental disorders using a multimodal method of assessment, potentially integrating subjective experiences with experimental assessments of affect, cognition, and physiology.

CONCLUSIONS

In the present study, we found that individuals with greater BPD symptoms use more ineffective ER strategies (e.g., suppression, rumination, avoidance) and fewer effective ER strategies (e.g., cognitive reappraisal, problem solving, acceptance) than healthy individuals and those with few BPD symptoms. Individuals with BPD also tend to use more rumination and avoidance (and less problem solving and acceptance) than those with other mental disorders. The way in which BPD

individuals select and implement ER strategies may therefore significantly contribute to their difficulties regulating their emotions and to their clinical presentations. Additional research is needed to determine the mechanisms underlying the difficulty of BPD clients in selecting more effective ER strategies. Nevertheless, this review used an affective-science perspective to outline potential reasons for emotion dysregulation in BPD and to identify features that contribute to ER difficulties in the disorder. The clinical implication is that interventions with BPD clients to decrease their ineffective ER strategies, and to increase effective ones, may lead to symptom improvement. Finally, our discussion points to several future research directions that may improve our understanding of ER strategy selection in BPD and other mental disorders, ultimately leading to improved treatment.

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