Emotion regulation strategies in bipolar disorder: A systematic and critical review.

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Abstract

Background: Theoretical frameworks emphasise associations between interpretations and responses to affect and bipolar disorder (BD). This review (PROSPERO CRD42016043801) investigated which emotion regulation (ER) strategies have been applied to BD, are elevated in BD compared to clinical and non-clinical controls, and are associated with clinical and functional outcomes in BD. **Methods:** Search terms relating to emotion regulation, coping and bipolar disorder were entered into Embase, MedLine and PsycInfo. Quantitative studies investigating relationships between ER strategies and BD were eligible for this narrative synthesis. **Results**: A large volume of research (n = 47) investigated specific ER strategies in BD. Maladaptive strategies such as rumination and dampening were elevated in BD compared to controls and these particular strategies had a detrimental impact on outcomes such as mood symptoms. BD had a similar profile of ER strategies to unipolar depression, but there was limited comparison to other clinical groups. People with BD did not generally have deficits in using adaptive strategies, as evidenced by comparisons with controls and experimental studies. **Limitations:** Methodological heterogeneity and a lack of ecologically valid ER assessments. **Conclusions:** Empirical literature is critiqued in line with contemporary theories of BD and of emotion regulation more generally, in order to inform future research recommendations. This includes investigation of the importance of context in the impact of ER strategies, and discrepancies between trait and state use of ER strategies, particularly through experience sampling.

Keywords: Bipolar disorder; emotion regulation; response styles; mania; depression; rumination

Introduction

Bipolar disorder (BD) is characterised by periods of mania and depression (American Psychiatric Association, 2013). Despite treatment, outcome is variable, with many individuals experiencing a relapsing-remitting course and impaired functioning (Gitlin & Miklowitz, 2017). To improve treatments, there is a major need to understand the psychological mechanisms that may contribute to the symptoms of BD. This review concerns emotion regulation (ER) strategies, a set of putative mechanisms.

Gross' (1998) process model conceptualises ER as effortful and automatic attempts to downregulate, upregulate or sustain emotions that can be antecedent-focused (before the emotion is generated) or response-focused (enacted after the emotion is generated). Given the traditional delineation of ER strategies as adaptive or maladaptive, there has been considerable interest in the role of ER strategies in psychopathology. Reviews of ER strategies and psychopathology have either excluded BD (Aldao et al., 2010), only included fMRI studies (Townsend & Altshuler, 2012), focused on one specific ER strategy (e.g., rumination; Silveira & Kauer-Sant'Anna, 2015), or on positive emotion regulation in cross-diagnostic samples (Carl et al., 2013).

Both positive and negative emotion regulation are clinically and theoretically relevant to BD. Firstly, as well as mood episodes, people living with BD experience significant affect instability and intensity between episodes (Henry et al., 2008). While regulating positive or activated moods can be problematic in those with BD, which is defined by excessively high mood states (Gruber, 2011a), extremes of low mood are also characteristic of BD, as are mixed states. Even the majority of manic episodes involve both negative and positive affect, and low and high *activation* (for a review, see Mansell & Pedley, 2008).

Secondly, psychological models of BD emphasise emotion regulatory processes. For example, Response Styles Theory (RST; Nolen-Hoeksema, 1991) proposes that responding to low mood by ruminating leads to further depression, whereas distraction upregulates mood (Lyubomirsky et al, 2015). Ruminating on positive affect would be expected to amplify high moods (Feldman et al., 2008), whereas responding by dampening positive affect is potentially linked to depression (Feldman et al., 2008). Depression avoidance theory suggests that mania arises when people try to avoid depression by engaging in activating behaviours (e.g. risk-taking; Thomas & Bentall, 2002). Emotion-relevant facets of impulsivity, such as urgency (emotion-based rash action), have stronger links with risk of BD compared to 'non-emotional' impulsivity (Johnson et al., 2013). Both positive and negative urgency are of relevance to emotion regulatory processes in BD in the same way as other response styles to negative and positive affect, which are all tendencies to respond to emotions in particular ways.

These responses may be driven by how people appraise the way they feel, as people seek to avoid mood states that have been problematic for them. A model of BD that draws upon multilevel models of emotion (Jones, 2001), and an integrative cognitive model (ICM; Mansell et al., 2007), both propose that individuals vulnerable to BD make extreme, self-referent appraisals of both low and highly activated internal states (e.g., mood, energy). Subsequent ER attempts depend on whether the appraisal is positive or negative, whereby a positive appraisal would be expected to lead to regulation attempts focused on sustaining or enhancing, while a negative appraisal would prompt attempts to alleviate. This demonstrates a clear clinical and theoretical association between BD and propensity to engage in processes that lead to excessive upregulation and downregulation of both positive and negative affect.

The aims of this review were to: i) describe how ER strategies are conceptualised and assessed in relation to BD; explore which ER strategies are engaged in more by people with

BD compared to ii) non-clinical controls and iii) clinical controls; iv) explore whether ER strategies are associated with relevant clinical and functional outcomes; and v) summarise conceptual and methodological features of the literature in order to inform future research.

Method

Search Strategy

The protocol is available at www.crd.york.ac.uk/prospero/ (CRD42016043801). A systematic search was conducted using Medline, PsycInfo and Embase, identifying peer-reviewed articles published between January 1980 and June 2016, with a second search in September 2017. Search terms related to BD, ER strategies (including 'response styles' and 'coping styles', as used throughout the literature). Combinations of broad terms for ER and specific strategies, in line with existing reviews on ER and psychopathology (Aldao et al., 2010; Carl et al., 2013; Gruber, 2011a; Townsend & Altshuler, 2012). Specific strategies relevant to BD were selected based on authors' familiarity with the literature and informed by existing reviews. The search terms were "exploded" in the field of BD.

Reference lists of relevant reviews (Aldao et al., 2010; Carl et al., 2013; Gruber, 2011b; Townsend & Altshuler, 2012) and eligible papers were screened. Ten key researchers publishing in the area were contacted.

Eligibility

Emotion regulation strategies were defined as "processes individuals engage in to initiate, maintain, intensify, or eliminate mood states" (Gross, 1998, p. 275). This included strategies conceptualised as both adaptive and maladaptive. Experimental, case-control, and correlational studies (cross-sectional and prospective) were eligible, as long as they used a

quantitative measure of ER strategies and compared use of these strategies between people with BD and controls, or investigated associations with clinical and functional outcomes in BD specifically (not mixed clinical or community samples). Eligible studies included a sample of people formally diagnosed with BD according to Diagnostic and Statistical Manual (DSM) or the International Classification of Diseases (ICD-9 or ICD-10). To adhere to diagnostic criteria from DSM-III onwards, articles published before 1980 were excluded. Studies including child, adolescent, and adult samples were eligible, to allow for exploration of ER strategies across the lifespan. Finally, only peer-reviewed journal articles available in English were eligible.

Studies were excluded if they: did not measure or experimentally manipulate a named ER strategy as per author definition; only investigated general deficits (e.g, ability to regulate) rather than specific strategies (e.g., rumination); had not been peer-reviewed or were not available as full-text (e.g., book chapters, dissertations, conference abstracts); had no empirical data (e.g., reviews, protocol papers).

Screening Process

Articles were screened at title level, and 30% were independently reviewed (93.9%, k=.70). Next, articles were screened at abstract level, with 25% of abstracts independently reviewed (91.2%, k=.78), achieving adequate interrater reliability. Remaining articles were screened at full article level. In cases where there was uncertainty, authors met to reach a consensus. The original intention was to include studies investigating ER strategies in relation to mania risk in non-clinical samples. However, these articles were excluded, as the volume of research suggested these merited a separate publication. The use of a quality assessment tool (e.g. the Newcastle-Ottawa quality assessment tool) was explored, but were not appropriate for the majority of studies, which used a range of methods.

Results

Study and sample characteristics.

Figure one shows the article screening process. Forty-seven articles were included. Methods and key findings are summarised in Tables 2 and 3. In case-control studies, the most common comparator groups were non-clinical (24 studies) and unipolar depression (UPD; 12 studies). Twenty studies examined associations between ER strategies and clinical, affective or functional outcomes. Of these, six used a prospective design. Self-report questionnaires were most frequently used (n = 41), although thirteen studies used experimental paradigms to investigate between-subjects or within-subjects effects of instructed or spontaneous ER strategies. Case-control, experimental and correlational designs were often reported within the same article. Only one study included participants aged <18 years. Around half (n = 23) recruited individuals with bipolar disorder 1 (BD-I). The majority (n = 27) only included euthymic participants. Table one gives details of the theoretical frameworks driving hypotheses and the selection of ER strategies across studies. This demonstrates overlap in constructs assessed by different measures.

Regulating negative affect

Rumination. Rumination was consistently endorsed more by people with BD compared to non-clinical controls. By contrast, rumination did not differentiate people with BD from people with unipolar depression (UPD), even when controlling for current depression. Trait ER use was comparable with insomnia (Gruber et al., 2008) and borderline personality disorder (BPD; Bayes, Parker & McClure, 2016; Fletcher et al., 2014a), higher than those with anxiety disorders (Kim, Yu, Lee, & Kim, 2012), and mixed regarding comparisons with schizophrenia (despite similar study methodologies; Rowland et al., 2013a, 2013b). Typically,

case-control studies did not match groups *a priori*. Additionally, the extent to which group differences on potentially confounding demographic and clinical variables were tested or controlled for in analyses was variable. This is particularly notable given group differences were dependent on mood in some studies. For example, one study reported that differences on rumination between BD and controls were not upheld when controlling for mood (Gruber et al., 2008). Another study noted that only currently manic and depressed (Thomas et al., 2007), but not euthymic, individuals with BD differed from controls, a finding not replicated by later studies looking at different phases of BD, which reported all groups had higher rumination scores than controls (Batmaz et al., 2014; Van der Gucht et al., 2009). Similarly, one study reported higher scores in current bipolar depression compared to current unipolar depression (Kim et al., 2012).

Demonstrating that people with BD have higher self-reported ER scores than controls does not tell us which ER strategies are related to affective disturbances in BD. Greater emphasis should be placed on studies that directly investigate associations between ER strategies and outcomes. In experimental studies, there were no differences in emotional responses to rumination manipulations between BD and either non-clinical controls or UPD (Gilbertet al., 2013; Gilbert & Gruber, 2014; Gruber et al., 2011). Seven of nine cross-sectional studies investigating relationships between rumination and mood symptom reported positive associations with depressive symptoms (Alloy et al., 2009; Green et al., 2011; Gruber et al., 2011; Pavlickova et al., 2013; Rowland et al., 2013a; Van der Gucht et al., 2009), whereas only three of seven studies reported positive associations with manic symptoms (Alloy et al., 2009; Green et al., 2011; Rowland et al., 2013a).

Similar to case-control studies, most cross-sectional studies recruited euthymic individuals. Two reported that rumination predicted depression in “softer” bipolar spectrum

conditions (BD-II, cyclothymia) over follow-up periods from 6 months to 38 months, even when controlling for baseline mood symptoms (but not any further clinical characteristics; Alloy et al., 2009; Fletcher et al., 2014b). However, both depressive and manic symptoms were predicted by rumination in BD-I only (Fletcher et al., 2014b). In these longitudinal studies, findings differed according to the way of assessing mood (e.g., self-reported versus observer-rated, or occurrence versus frequency of mood episodes), as well as by BD subtype. In a more direct test of whether rumination is tied to mood symptoms, a randomised controlled trial of ER-focused therapy reported that greater reductions in depression were seen for those who reported greater reductions in rumination during and after therapy (Ellard et al., 2017).

In this same trial, changes to rumination did not predict functioning, but did predict lower anxiety (Ellard et al., 2017). Rumination is also associated with higher anxiety and stress when controlling for the effect of other cognitive ER strategies (Green et al., 2011; Rowland et al., 2013a). Looking at potential factors related to the occurrence of ruminative response styles, neither history of childhood abuse or attentional bias to emotion were related to rumination (Peckham et al., 2016b; Perich et al., 2014).

Catastrophising, self-blame, and blaming others. Studies consistently found that self-blame and catastrophising were endorsed more by people with BD relative to controls, whereas blaming others did not differentiate these groups. As with rumination, tendencies to catastrophise were comparable with UPD (Fletcher et al., 2014a; Kjaerstad et al., 2016; Van Meter & Youngstrom, 2016; Wolkenstein et al., 2014) and schizophrenia (Rowland et al., 2013a, 2013b), but less in comparison to BPD (Bayes et al., 2016; Fletcher et al., 2014a). In these same studies, BD was comparable to UPD for both self-blame and blaming others, while there is some evidence that people with BD were more likely to engage in self-blame

compared to people with schizophrenia but less likely compared to people with BPD. Findings for blaming others were less clear cut, and overall there were few studies comparing BD to schizophrenia and BPD.

Three studies explored cross-sectional relationships between mood symptoms and these strategies (Green et al., 2011; Rowland et al., 2013a; Wolkenstein et al., 2014). Divergent findings here make it difficult to draw conclusions and cannot be explained by methodological rigour; one had a markedly smaller sample size (Wolkenstein et al., 2014), but otherwise these studies were methodologically similar. There is no experimental evidence to investigate the effect of using these strategies, and the only longitudinal study reported no significant associations with mood symptoms, potentially hampered by the inclusion of multiple predictor variables (Fletcher et al., 2014b).

Suppression. One study reported comparable suppression between BD and controls, but did not control for current mood (Johnson et al., 2016). However, people with BD reported greater use of suppression in BD compared to non-clinical controls in two studies (Gruber et al., 2013; Gul & Khan, 2014), including one that used an ecologically valid experience sampling methodology (ESM) approach measuring engagement in ER over six days (Gruber et al., 2013). In line with this, an experimental study found that those with BD engaged in spontaneous suppression more often (Gruber et al., 2012). Only one study looked at suppression and mood symptoms (Johnson et al., 2016), finding a positive association with concurrent depressive, but not manic, symptoms. This same study reported that suppression did not predict mood symptoms assessed after 12 months, and was also unrelated to QoL, when controlling for baseline symptoms. However, the follow-up sample was small.

Risky and impulsive responding. There was evidence that risk-taking was dependent on current mood status, as scores were highest in people with BD who were

currently manic compared to those who were currently depressed or euthymic (Thomas et al., 2007; Van der Gucht et al., 2009). Risk-taking was only higher in euthymic BD compared to controls when mood was not controlled for (Jones et al., 2006; Pavlickova et al., 2014; Perich et al., 2011). Initial evidence suggests people with BD have a greater tendency towards negative urgency than controls (Muhtadie et al., 2014). Risk-taking was comparable in BD and UPD; only one study reported higher scores in BD, but not when controlling for current mood (Fletcher et al., 2013).

One study reported positive associations between risk-taking and mood symptoms (Pavlickova et al., 2013), while another found no significant relationships (Van der Gucht et al., 2009). Risk-taking was related to depression but not mania in a longitudinal study (Fletcher et al., 2014b). Negative urgency was not investigated in relation to mood symptoms, and had no relation to functioning (Muhtadie et al., 2014) or suicide/self-harm, but was positively related to substance use and suicidal ideation (Johnson et al., 2017).

Active coping. Active coping comprises distraction and problem-solving. As a putatively adaptive ER strategy, people with BD would be expected to use active coping less often than controls, and it would hypothetically alleviate mood symptoms. However, people with BD reporting using distraction just as often as controls in the majority of studies, including experimental paradigms (Hay et al., 2015; Kanske et al., 2015). These studies do not tell us about unprompted active coping. Without instruction, active coping was *spontaneously* used more often by people with BD relative to controls in the laboratory (Gruber et al., 2012), and compellingly, using ESM (Gruber et al, 2013). There were no differences between BD and UPD, again including the ESM study (Gruber et al., 2013). Although it was unexpectedly related to higher symptoms in some cross-sectional studies (Alloy et al., 2009; Pavlickova et

al., 2013), evidence suggested active coping was unrelated to current and prospective mood symptoms (Alloy et al., 2009; Fletcher et al., 2014b).

Cognitive reframing and acceptance. The evidence suggested putting into perspective, refocusing on planning, positive refocusing or acceptance were not related to having BD or to its symptoms, across case-control, cross-sectional and longitudinal studies. Of remaining putatively adaptive ER strategies, reappraisal was investigated most often. Overall, the number of studies reporting lower endorsement of reappraisal in BD relative to controls was equivalent to the number of studies reporting comparable endorsement. There is no clear pattern whereby discrepant findings were explained by methodological differences such as better-controlled, larger studies. For example, none of these studies controlled for current symptoms, and few matched groups. Gruber and colleagues' (2013) ESM study found no differences in use of reappraisal over time compared to controls and UPD. In addition, well-controlled experimental studies found that individuals with BD were just as able to use instructed reappraisal to regulate negative emotion (Corbalán, Beaulieu, & Armony, 2015; Gruber et al., 2014; Hay et al., 2015; Kanske et al., 2015; Kjærstad et al., 2016). However, this was not unanimous; one study reported impaired downregulation in BD assessed via brain activity (Kanske et al., 2015), while people with BD scored higher on 'spontaneous' reappraisal (Gruber et al., 2012). The majority of evidence suggests that people with BD do not have a deficit in using reappraisal, and that it is related to better outcomes in prospective studies even when controlling for baseline symptoms, including lower depression (Fletcher et al., 2014b; Johnson et al., 2016) and stress (Green et al., 2011; Rowland et al., 2013a).

Regulating positive affect

Amplifying. Ruminating on positive affect is a cognitive amplifying strategy, by its nature immersive and expected to increase positive emotion, link to high mood symptoms,

and therefore be unique to BD. The pattern of findings did not support this when comparing to non-clinical controls and UPD, particularly when current symptoms were controlled for.). Experimental findings suggest that, while ruminative processing of positive memories did link to heightened positive emotion, the effects were similar in BD and controls (Gruber et al., 2009). Associations with symptoms were mixed depending on how symptoms were assessed and by BD subtype (Fletcher et al., 2014a; Gilbert et al., 2013; Johnson et al., 2016).

Amplifying behaviours include positive urgency (mood-based rash action) and a range of upregulating ascent behaviours (e.g., ignoring advice from others). One study reported that people reported higher positive urgency than controls (Muhtadie et al., 2014). Positive urgency was related to higher depressive (but not manic) symptoms (Johnson & Carver, 2016), poorer functioning and QoL (Muhtadie et al., 2014; Victor et al., 2011), and higher rates of self-harm/suicide, substance use, anxiety disorders, and anger/aggression (Johnson & Carver, 2016; Johnson et al., 2017). Ascent behaviours capture a range of upregulating strategies including ignoring advice from others. These were investigated in just one study, which reported a positive association with manic symptoms, but no association with depression (Palmier-Claus et al., 2015).

The small number of studies investigating amplifying behaviours suggests these are an unhelpful, but this is tentative given the lack of prospective research

Dampening. Dampening would be expected to attenuate positive emotional reactivity. As expected, dampening was elevated in BD relative to non-clinical controls, although people with BD engaged with, and responded to, both instructed and spontaneous self-distancing in a similar way to controls (Gruber et al., 2009; Park et al., 2014). Dampening was mostly comparable between BD and UPD, with one exception where those with BD had higher scores (Shapero et al., 2015). Few studies investigated the influence of dampening on mood

symptoms, but evidence suggested that dampening predicted both manic and depressive symptoms after six months, when controlling for baseline mood symptoms (Fletcher et al., 2014b; Gilbert et al., 2013). In a further test of its associations with outcomes, dampening was negatively related to QoL, even when controlling for key demographic and clinical variables (Edge et al., 2013).

Discussion

This review explored whether a range of specific ER strategies are related to BD. Overall, people with BD have a greater propensity to respond to positive and negative emotions in particular ways compared to non-clinical controls. As ER profiles appear similar to other clinical groups, engagement in such strategies may be transdiagnostic. There is growing evidence that these strategies are associated with clinical and functional outcomes.

Differences between BD and non-clinical and clinical controls

Findings across case-control studies suggest that participants with BD endorse putatively maladaptive strategies for regulating negative affect such as rumination, self-blame, suppression and catastrophising more strongly than non-clinical controls, but have a similar ER profile to people with UPD. This is in line with existing literature that suggests certain ER strategies, particularly rumination, are related to psychopathology (Aldao et al., 2010; Ehring & Watkins, 2008; Silveira & Kauer-Sant'Anna, 2015). Overall, evidence suggested that people with BD did not have difficulties responding to negative affect with acceptance, problem-solving, reappraisal and distraction, which the literature suggests are adaptive in relation to psychopathology (Aldao et al., 2010).

Few studies looked at strategies for regulating positive affect. Interestingly, rumination in response to positive affect (amplifying) did not consistently differentiate those

with BD from controls or UPD. While dampening positive affect was higher in BD compared to controls, it did not distinguish BD and UPD. Theory suggests that dampening could be specific to BD as an attempt to avoid problematic highs, but there is evidence in the wider literature that dampening is related to depression more generally (Carl et al., 2013; Raes et al., 2012), and heightened dampening in UPD relative to controls (Werner-Seidler et al., 2013). Tendencies to dampen positive emotions in BD and UPD could be due to a detriment in sustaining or enhancing positive emotions (i.e., savouring) among people with a history of depression, irrespective of whether they have had (hypo)manic experiences. Further, it may be that measures of positive rumination are not extreme enough to represent excessive upregulation, and instead overlap with 'adaptive' savouring responses. More research is needed to explore the construct of amplifying, including further work on behavioural responses such as positive urgency and ascent behaviours.

Differences between BD and non-clinical samples were less pronounced in experimental studies. People with BD were able to employ 'adaptive' strategies such as distraction and reappraisal just as well as controls. However, there is some evidence that individuals with BD are more likely to spontaneously engage in regulatory attempts more often than non-clinical controls, in both experimental and real-world contexts. Notably, even when there were no differences from controls, people with BD perceived they had made more effort to regulate emotions, but had been less successful (Gruber et al., 2012). These regulatory attempts could be driven by the experience of more intense affect among people with BD. This could impede the helpfulness of ER, leading to further mood symptoms. Investigating the direct associations between ER strategies and outcomes, rather than whether people with BD score more highly on trait-based measures, provide stronger evidence for whether these strategies are helpful or unhelpful.

Associations between ER strategies and key outcomes

In the laboratory, both positive and negative ER strategies had similar immediate effects across groups; 'maladaptive' strategies influenced mood detrimentally, while 'adaptive' strategies had a beneficial effect on mood, irrespective of whether participants had BD, UPD or neither. Across cross-sectional and prospective designs, ER strategies endorsed more often by people with BD compared to controls were associated with mania and depression and - to a lesser extent - other symptoms characteristic of BD (e.g., anxiety). The evidence was most compelling for negative rumination, even when accounting for the impact of other ER strategies in analyses (e.g., Fletcher et al., 2014b; Pavlickova et al., 2013; Rowland et al., 2013a). There was evidence that putatively maladaptive ER strategies were related to having more difficulties with further outcomes, historically and concurrently. For example, use of dampening was associated with poorer QoL (Edge et al, 2013), and substance use was correlated with higher negative and positive urgency (Johnson & Carver, 2016; Johnson et al., 2017). The broad range of outcomes investigated demonstrates the importance and high level of interest in exploring how ER strategies are related to BD. However, while there is some evidence for a link between ER strategies and outcomes other than mood symptoms in BD, there is a lack of empirical work specifically focused on ER and functional outcomes, as has been noted elsewhere (Van Rheenen & Rossell, 2013). While there are many strengths, current evidence is also constrained by methodological limitations.

Strengths, limitations and key considerations

Links between particular ER strategies and BD have been replicated across studies, namely rumination, catastrophising, self-blame and suppression in response to negative affect. Findings are promising for positive emotion regulatory attempts such as dampening and urgency, paving the way for further work on these. Although these ER processes may not

be unique to BD, given similar findings with other clinical groups, they are still problematic for people with BD. This is illustrated by consistent evidence that people with BD have greater propensity to engage in these ER strategies than non-clinical controls (even when matched by age and gender, and controlling for symptoms), as well as by their associations with key outcomes in both cross-sectional and, importantly, experimental and prospective studies.

While findings relating to negative ER strategies such as rumination and catastrophising are consistent across multiple studies and methods, and findings are promising for positive emotion regulation strategies playing a role in BD symptomatology, for some specific strategies, there was no large volume of evidence for their association with a particular outcome. For example, there was limited evidence that cognitive ER strategies such as acceptance and cognitive reframing were uniquely related to BD or outcomes pertinent to BD. There was variation in ER measures used and ways of assessing outcomes (e.g., assessing symptoms in terms of severity, frequency or variability). This heterogeneity makes it difficult to synthesise and explore commonalities. In this respect, including a broad range of ER strategies and outcomes is both a strength and a limitation of this review. Nonetheless, strategies traditionally considered ‘maladaptive’ appear important to BD, whereas those considered ‘adaptive’ do not seem to be related to whether or not someone has BD or their mood symptoms.

There is some evidence that the context of ER is important (e.g., Stange et al., 2015), but further psychological factors were included as separate candidate mechanisms or covariates, rather than mediators and moderators of ER strategies. As such, it is difficult to draw conclusions about the unique contribution of ER strategies or interactions between ER

strategies and other mechanisms. This would be important to determine "when", in addition to "what", strategies are useful (Webb et al., 2012a).

In addition, studies measured different confounding demographic and clinical factors. Firstly, most studies focused on BD-I, and this may not give the full picture in light of evidence that ER differs across subtypes (Fletcher et al., 2013, 2014). Further, mood disturbances characteristic of BD, as well as clinical factors such as number of past mood episodes and comorbidity, all potentially contribute to engagement in ER when experiencing intensifying high and low mood symptoms. People with BD have periods of (hypo)mania, depression, and mixed states as well as euthymia. ER may also differ across these episodes, as indicated by studies that included currently manic or depressed participants (Thomas et al., 2007; Van der Gucht et al., 2009). The balance of evidence towards ER strategies playing a role in depression may be partly explained by a high incidence of residual depressive symptoms but low levels of current manic symptoms in euthymic samples (Samalin et al., 2016), as well as the focus on responses to negative emotion.

There is potential circularity between having more extreme moods in the first place and engaging in ER more frequently, with initial intensity of affect making it more difficult to successfully regulate affect. These complexities have not been fully examined to date, and many studies failed to control for mood when comparing ER strategies in BD with non-clinical and clinical controls, coupled with a lack of prospective studies to control for baseline mood. This is problematic given ER measures have been criticised for overlap with symptoms (for example, rumination and depression; Treynor et al., 2003), and the same criticism could be applied to positive rumination and hypomania, and dampening and depression. Despite observations that positive emotion persistence can be problematic in BD (Gruber, 2011a), mania is not solely defined by elated mood but also activation and

irritability (as well as a range of behavioural symptoms). Existing ER measures do not capture these aspects of the 'highs'.

In general, sample sizes were relatively small and only two papers reported a power analysis, both posthoc (Hay et al., 2015; Peckham et al., 2016a). Most studies used a 'snapshot' cross-sectional design, yet studies where ER strategies temporally precede outcomes provide the most compelling evidence that ER strategies predict outcomes. Experimental studies offer one way of testing the immediate effects of ER strategies on outcomes. However, these lack ecological validity, and have explored a limited range of strategies. Further, these only included euthymic participants, with some specifically noting the sample was high functioning (e.g., Gruber et al, 2014). This could mean participants were more successful at instructed ER compared to those in episode, or compared to their own ER in everyday life.

Existing prospective findings suggest ER strategies are linked to subsequent symptoms. However, even these do not test dynamic associations between ER and outcomes over time. Real-world methodologies, such as ESM, offer the best means of addressing these key questions as they can measure the concurrent and micro-longitudinal relationship between affective state and ER strategies in real world settings (Palmier-Claus et al., 2011). This would help to establish the short-term directionality of the observed relationships and provide much needed information on the contexts in which ER strategies are helpful or unhelpful. ESM studies included here both assessed a limited range of pre-determined strategies, and did not report the influence of ER strategies on clinical or functional outcomes over time (Gruber et al., 2013; Pavlickova et al., 2013).

Theoretical Perspectives & Future Research Directions

There is a lack of synergy between research on ER in BD and psychological models of BD. Models of ER emphasise that appraisals and valuations of emotions and ER strategies (e.g., “good for me” versus “bad for me”) shape decisions regarding when and how they regulate (Webb et al., 2012b; Gross, 2015). The extended process model (Gross, 2015) uses the example of positive valuations of early manic symptoms leading to selection and implementation of an upregulating ER strategy that has previously brought short-term gains (“I can get more done because I am full of energy”), without consideration of longer-term adverse effects.

This emphasis on links between how people interpret emotions and the ER strategies they select is shared by psychological models of ER and of BD. The latter suggest people with BD hold enduring beliefs and appraisals about their mood and emotions which are positive *and* negative, and drive selection of ER strategies (e.g., Jones, 2006; Mansell et al., 2007). This is analogous to the perception-valuation-action cycle in the extended process model, where people have goals about how they want to feel and this influences ER (Gross, 2015). For example, in applications of Nolen-Hoeksema’s (1991) Response Styles Theory to BD (e.g., Thomas et al., 2007), it has been suggested that low mood is related to strategies such as rumination, whereas if people have the goal to avoid low mood and engage in strategies such as risk-taking, this escalates high mood. Findings here supported the RST, for example, ruminative response styles were linked to BD and to depressive symptoms.

The ICM suggests that regulatory goals can be conflicting in BD, as people interpret affect in conflicting ways (Mansell et al., 2007). A negative appraisal of positive affect would be expected to prompt attempts to downregulate such as dampening, whereas a positive appraisal would be expected to prompt attempts to upregulate, such as amplifying (Feldman et al., 2008).

As such, push-and-pull between opposing valuation systems (Gross, 2015) could be one of the mechanisms underlying the ups-and-downs of mood characteristic of BD, as conflicting appraisals of affect over time may mean a target state is difficult to attain (Mansell et al., 2007). For instance if upregulating positive affect is successful but then this is appraised negatively as a sign of escalating high mood, this could lead to further regulation attempts in the opposite direction. This would then influence dynamic ER processes as outlined in the extended process model, where switching strategy too often, not switching from an ineffective strategy, not stopping regulating, stopping regulating too soon, or using unhelpful blends or sequences of ER strategies impede effective ER and explain links between ER and psychopathology (Gross, 2015; Sheppes et al., 2015). For example, in BD, not following up successful downregulation of positive affect with a strategy for maintaining a more balanced mood, and engaging in further downregulation instead, could foster depressed mood.

Recent theoretical frameworks also emphasise the importance of regulatory flexibility (using context-appropriate strategies, being adaptable, and having access to a diverse range of strategies; Bonanno & Burton, 2013; Gross, 2015; Webb et al., 2012b). Linked to this, the notion that certain strategies are maladaptive while others are adaptive has been described as the ‘fallacy of uniform efficacy’ (Bonanno & Burton, 2013). For example, while upregulating positive affect is generally seen as healthy in non-clinical populations (Tugade & Fredrickson, 2006), theory suggests that this can be counterproductive in BD (Gruber, 2011a). Similarly, downregulating positive mood may not be detrimental in all contexts (Koole, 2009). However, the dynamic and contextual nature of ER is yet to be explored in BD. Are putatively maladaptive strategies actually engaged in more by people with BD as case-control studies would suggest? Or, are different ER strategies used by people with BD in specific contexts (e.g., affective states or situations) that could explain why ER is problematic

in this population? Are regulation attempts more frequent due to more extremes in affect and its dysegulation, or noticing these fluctuations more, and having catastrophic views of these fluctuations and their personal meaning in line with lived experience of BD – some of which may accurately suggest regulation is required?

ESM has the potential to address these questions. This could include transitions between different phases of BD and the different ER profiles that may be present during euthymia, mania and depression, how different strategies may synergistically be present during mixed states, why particular strategies are selected, and the contexts in which regulatory attempts become problematic and predict clinically important outcomes.

As context is important, future research should investigate potential mediators and moderators of the effectiveness of particular ER strategies. For example, there is evidence that distraction is not necessarily adaptive and suppression not necessarily maladaptive, depending on factors such as concurrent use of additional strategies or culture (Butler et al., 2007; Wolgast & Lundh, 2016). Further, rumination appears to be more detrimental for females compared to males (Lyubomirsky et al., 2015). Further psychological mechanisms are likely to influence how people regulate emotions. These include the overlapping constructs of the extent to which people make valuations of their emotions versus accept them (Van Rheenen et al., 2015), and the metacognitive or metaemotional beliefs people hold (e.g. Norman & Furnes, 2016). In addition, ER strategies are likely to be influenced by, but also influence, mechanisms that have been specifically linked to BD (Thomas et al., 2007), including imagery (Holmes et al., 2008), ambitious goal-setting, excessive goal pursuit, and reward sensitivity (reviewed extensively elsewhere; Gruber, 2011b; Johnson et al., 2012; Urošević et al., 2008). Future studies should test whether these mediate or moderate

relationships between ER and outcomes (Aldao & Christensen, 2015; Webb et al., 2012b) to improve understanding of *when* ER strategies are effective (or not).

Clinical Implications

Emotions and moods have been distinguished from one another in the ER literature, and ER, mood regulation, and coping are generally considered to be different (but linked) processes (Gross, 1998). These latter strategies were omitted from this review to facilitate the synthesis of findings. However, psychological therapy models of BD emphasise the influence of coping with early warning signs (prodromes) of hypomania and depression (e.g., Lam & Wong, 2001). These coping processes are similar to ER strategies such that they involve enacting cognitive and behavioural coping strategies with the intention of reducing (or enhancing) symptoms, not as attempts to change the environment or situation (problem-focused coping). Improving coping strategies is a key facet of relapse prevention (Morriss et al, 2007). However, while avoiding future relapse is important, current difficulties, and not just episodes of hypomania and depression, should be acknowledged in therapy (Mansell et al., 2014), and improving ER and tolerance of emotions is a potentially useful mechanism in therapy (as demonstrated in a transdiagnostic sample; Berking et al, 2008).

The majority of evidence reviewed here points to potential transdiagnostic approaches for BD because of the preponderance of ER strategies around negative affect (mainly rumination) that are shared with other disorders, most specifically UPD. A transdiagnostic, emotion-focused therapeutic model, the Unified Protocol (Wilamowska et al, 2010), has shown promise in an initial trial among people with BD (Ellard et al, 2017). Studies that test whether ER strategies mediate outcomes in therapy (as in Ellard et al, 2017), will be useful to unpick the role of these strategies further.

We have reviewed empirical and theoretical justifications for not attempting to replace apparently 'maladaptive' strategies with 'adaptive' ones. Instead, clinicians should work with the client to develop and test working hypotheses around the cost and benefits of the ER strategies they use in particular context, in order to help them to meaningfully change their response. This could be achieved through cognitive behavioural therapy (CBT; Mansell et al., 2014), functional analysis, or Dialectical Behavior Therapy (DBT; Linehan, 1987)

Conclusions

This review found evidence that people with BD engage in strategies that both enhance and dampen positive affect, and aggravate negative affect, more often than non-clinical controls but in a similar way to people with UPD. Negative emotion regulation strategies such as rumination and catastrophising appear particularly problematic in BD, as does dampening positive affect. The varied methods and types of ER strategies investigated make it difficult to draw any definitive conclusions for other strategies for regulating negative emotions. Strategies for regulating positive affect make sense theoretically given potential links to (hypo)mania, but are under-researched. Research should look beyond whether specific strategies are elevated in BD, or whether they are associated with current mood symptoms and functioning. Further experimental and longitudinal research is required, including consideration of the dynamics and context of emotion regulation.

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Table 1: Emotion regulation strategies & measures

ER strategy	Definition	Relevant constructs	Relevant theoretical framework(s)	Corresponding self-report measure(s)	Scale development and validation papers
	Regulating negative emotions & depression				
Suppression	Inhibition of the emotional experience or expression, hiding feelings		Process model (Gross, 1998, 2015)	Emotion Regulation Questionnaire	Gross and John (2003)
Negative rumination	The tendency to respond to negative mood states with increased thoughts about negative attributes and negative life experiences.	Reflection (a more neutral form of thinking about and coping with depression); Brooding (a more absorbing, negative emotion-focused rumination)	Response Styles Theory (RST; Nolen-Hoeksema, 1991)	Response Styles Questionnaire (RSQ) Ruminative Responses Scale (RRS)* Leahy Emotional Schema Scale Global Rumination Scale	Nolen-Hoeksema and Morrow (1991) Thomas and Bentall (2002) Treynor et al. (2003) Leahy (2002) McIntosh and Martin (1992)

		Descent Behaviours Integrative Cognitive Model (ICM; Mansell, Morrison, Reid, Lowens, & Tai, 2007)	Process model (Gross, 1998, 2015)	Cognitive Emotion Regulation Questionnaire (CERQ) Behaviours Checklist (BC)	Garnefski and Kraaij (2007) Fisk, Dodd, and Collins (2015)
Risk-taking	Engaging in risky (or impulsive, rash) behaviours for example excessive drinking in response to depressed mood	Dangerous activities Negative urgency	RST Depression avoidance (Neale, 1988) Five factor personality model for impulsive behaviours (Whiteside & Lynam, 2001)	RSQ UPPS	Whiteside and Lynam (2001)
Negative focus	Over emphasising the negative aspects of an experience and predicting the worst possible outcome. Focussing on self-critical thoughts, blaming self or others for events /	Catastrophising Self-blame		CERQ	

	situations that are not the complete responsibility of the individual.	Blaming others			
Descent behaviours	'Maladaptive' coping responses to negative emotion, such as withdrawal and self-medicating	Descent behaviours	ICM (Mansell et al., 2007)	BC	
Active (or *adaptive*) coping	Engaging in emotion regulation behaviours that are adaptive. For example problem solving and distraction through undertaking pleasant activities/ engaging in thoughts or behaviours to stop thinking about thoughts, feelings and symptoms.	Distraction and problem solving	Process model (Gross, 1998, 2015) RST	RSQ CERQ	
Cognitive reframing	Construing an event or experience in a way that adaptively alters a person's emotional response in a positive way.	Cognitive reappraisal Putting into perspective Positive refocusing, Refocus on planning	Process model (Gross, 1998, 2015)	CERQ ERQ	
Acceptance	Accepting and resigning self to the emotion being experienced		Process model (Gross, 1998, 2015)	CERQ	

	Regulating positive emotions & mania				
Dampening	The tendency to engage in strategies to reduce the intensity and duration of positive affect.		RST	Responses to Positive Affect Questionnaire (RPA)	Feldman, Joormann, and Johnson (2008)
	Reward avoidance as a strategy to avert mania.		Reward and goal dysregulation theory (Johnson, Fulford, & Carver, 2012)	Reward Responses Inventory (RRI)	Edge et al. (2013)
Amplifying	Thinking about positive attributes and positive life experiences, or engaging in strategies that enhance the intensity and duration of positive affect.	Positive rumination	RST	RPA	
	Mood-based rash action.	Positive urgency	Positive urgency (Cyders et al., 2007)	Positive Urgency Measure (PUM)	Cyders et al. (2007)
	Goal-focused activating behaviours such as stimulating activity and ignoring advice.	Ascent behaviours	ICM (Mansell et al., 2007)	BC	

*This is an abridged version of the RSQ excluding items that overlapped with depressive symptoms

Table 2: Study characteristics & summary of findings from experimental studies and associations with outcomes in BD

Author(s) (date)	Population (*n*)/ country	Design/method	ER strategies measured	Outcome	Summary of key findings	
					Experimental	ER strategies associated with clinical and functional outcomes in BD
Alloy et al. (2009)	University students; USA DSM-IV criteria or Research Diagnostic Criteria (RDC) *Cross-sectional:* Euthymic BD-II or cyclothymia *n* = 125 Non-clinical controls *n* = 149	Case control Longitudinal (38 months)	*Self-report* RSQ: Rumination Distraction	*Group differences* BD-II vs non-clinical controls *Mood symptoms (self-report)* HMI BDI *Mood episodes (observer-rated)* SADS-Change	--	*Cross-sectional* RSQ Rumination +ve associated with depressive symptoms RSQ Distraction -ve associated with depression RSQ Distraction +ve with manic symptoms *Prospective (controlling for symptoms)* RSQ Rumination did not predict occurrence of mood episodes but predicted more frequent depressive (but not manic) episodes RSQ Distraction did not predict any mood episodes
Batmaz et al. (2014)	Outpatients, acquaintances; Turkey DSM-IV criteria UPD *n* = 161 Currently depressed BD-I *n* = 140 Non-clinical controls *n* = 151	Case control	*Self-report* LESS Rumination	*Group differences* BD-I vs UPD vs non-clinical	---	--

Bayes et al. (2016)	Clinical services; Australia DSM-IV criteria BD-I and BD-II *n* = 83 Borderline Personality Disorder (BPD) *n* = 53	Case control	*Self-report* CERQ: Rumination Self-blame Catastrophising Blaming others Reappraisal Positive refocusing Refocus on planning Putting into perspective Acceptance	*Group differences* BD vs BPD	---	--
Corbalán et al. (2015)	Treatment program, community; Canada DSM-IV criteria Euthymic BD-I *n* = 19 Controls *n* = 17	Experimental	*ER instructions* 'Situational focused strategy' for cognitive reappraisal of negative emotion - 4 conditions: Neutral Look Neutral Decrease Negative Look Negative Decrease *Stimuli* IAPS – neutral and negative images	*Group differences* BD-I vs controls *Emotion: Self-report* Subjective affect ratings *Physiological* fMRI	BD-I > controls on neural response to Negative Look over time BD-I > controls on amygdala activity in both Negative Decrease and Negative Look conditions *Confounds* Groups not matched but checked differences on demographic variables Differences upheld when controlling for medication – did not control for group differences on depression	--
Edge et al. (2013)	Community; USA DSM-IV criteria Remitted BD-I *n* = 70 Controls *n* = 72	Case control Cross-sectional	*Self-report* RRI Reward Avoidance RPA: Self-focused rumination Emotion-focused rumination Dampening	*Group differences* BD-I vs non-clinical controls *Quality of life (Self-report)* QoL.BD	---	RPA Dampening –ve associated with QoL, controlling for confounds (demographics, illness history, treatment) but not when controlling for personality *BD group only* RRI Reward Avoidance not associated with QoL

Ellard et al. (2017)	Clinic, research programme; USA DSM-IV criteria Remitted BD-I and BD-II with comorbid anxiety disorder *n* = 29	Longitudinal (6 months) – part of randomised controlled trial	*Self-report* RRQ Rumination RSQ Rumination	*Mood symptoms (self-report)* QIDS ASRM *Anxiety (self-report)* Anxiety Symptoms Questionnaire *Mood Symptoms (observer-report)* HAM-D YMRS *Anxiety (self-report)* HAM-A	--	Baseline RRQ or RSQ Rumination did not predict subsequent change to observer-rated and self-reported anxiety or depression in either group *Treatment group only* Reductions in RSQ and RRQ Rumination associated with reduction in self-report anxiety scores Reduction in RRQ Rumination but not RSQ associated with reduction in observer-rated depression scores Baseline or change in Rumination did not predict functioning Associations not reported for manic symptoms
Fletcher et al. (2013)	Adverts (web/clinic), invites via research & treatment group; Australia DSM-IV criteria BD-I *n* =86 BD-II *n* = 107 Unipolar depression *n* = 96	Case control	*Self-report* RPA: Dampening Positive rumination RSQ: Rumination Risk-taking Active coping CERQ: Rumination Self-blame Catastrophising Blaming others Reappraisal Positive refocusing Refocus on planning Putting into perspective	*Group differences* BD-I vs BD-II vs UPD	--	--

Fletcher et al. (2014b)	Website, mood disorders clinic; Australia DSM-IV criteria BD-I *n* = 86 (69 at follow up) BD-II *n* = 107 (82 at follow up)	Longitudinal (6 months)	*Self-report* RPA: Dampening Emotion-focused rumination Self-focused rumination RSQ: Rumination Risk-taking Active coping CERQ: Positive Reappraisal Self-Blame Blaming Others Positive Refocusing	*Mood symptoms (self-report)* ISS *Mood episodes (observer-rated)* SCID	--	*Associations between depression severity over time* Both groups (BD-I and BD-II): RSQ Rumination, RSQ Risk-taking and CERQ Self-blame +ve associated with depression severity In BD-I only: CERQ Positive Reappraisal –ve associated with depression severity RPA Dampening +ve associated with depression severity No further ER strategies associated with depression severity in either group *Associations between depression variability over time* In BD-I only: RPA Self-focused Rumination +ve associated with depression variability In BD-II only: CERQ Self-blame and RSQ Rumination +ve associated with depression variability No other significant associations between ER strategies and depression variability in either group *Associations between mania severity over time* In both groups: RPA Dampening +ve with mania severity In BD-I only:

						RSQ Rumination +ve with mania severity No other significant associations between ER strategies and mania severity in either group *Associations between mania severity and variability over time* In BD-I only: RPA Self-focused and RSQ Rumination +ve mania variability In both groups: No further associations between ER strategies and mania variability in either group *Associations with manic and depressive episodes – ER strategies as simultaneous predictors* In BD-II only: RSQ Rumination and CERQ Self-blame +ve predicted depressive episode at 6 month follow up No further ER strategies predicted depressive episodes in either group No ER strategies predicted manic episodes in either group *Confounds* Controlled for age and baseline symptoms
Fletcher et al. (2014a)	Clinics, outpatients, community; Australia DSM-IV criteria	Case control	*Self-report* CERQ	*Group differences* BD-II vs BPD	--	--

	BD-II *n* = 24 Borderline Personality Disorder (BPD) *n* =24					
Gilbert et al. (2013)	Community; USA DSM-IV criteria Euthymic BD-I *n* = 31 (22 at follow up) Euthymic UPD *n* = 31 (24 at follow up)	Case control Experimental Longitudinal (6 months)	*Self-report* RPA *Experimental task* Goal visualisation followed by valence-neutral rumination manipulation	*Group differences* BD vs UPD *Emotion reactivity: Self-report* PANAS *Physiological* HR *Mood symptoms at baseline (observer-rated)* BRMS IDS-C *Mood symptoms at follow-up (self-report)* MDQ IDD-L	--	*Experimental* During rumination induction, in BD group, RPA Emotion-focus correlated with PA (+ve) while RPA Dampening correlated with HR and NA (+ve) *Prospective analyses* RPA Dampening +ve associated with manic and depressive symptoms RPA Self-focused and Emotion-focused not associated with manic or depressive symptoms *Confounds* Controlled for BL symptoms (prospective analyses)
Gilbert & Gruber (2014)	Community sample; USA DSM-IV criteria Euthymic BD-I *n* = 31 Euthymic UPD *n* = 31 Non-clinical controls *n* = 31	Experimental	Rumination vs mindfulness conditions (goal visualisation as above)	*Group differences* BD-I vs UPD BD-I vs non-clinical controls *Emotion reactivity:* *Self-report* PANAS *Physiological* HR (NA)	BD = UPD and controls on emotional reactivity to experimentally manipulated rumination or mindfulness *Confounds* Groups not matched but differences on demographic and mood variables tested.	--

				RSA (PA)		
Green et al. (2011)	Clinic, previous study samples; Australia DSM-IV criteria BD-I *n* = 105 Unaffected relatives, *n* = 124 Non-clinical controls, *n* = 63	Case control Cross-sectional	*Self-report* CERQ	*Mood symptoms (self-report)* DASS HPS	--	*ER strategies as simultaneous predictors* CERQ Rumination +ve associated with depressive and manic symptoms, anxiety, and stress CERQ Refocus on Planning –ve associated with depression CERQ Reappraisal –ve associated stress All other associations non-significant
Gruber et al. (2008)	University; USA, UK DSM-IV criteria Euthymic BD-I *n* = 21 Insomnia *n* = 19 Non-clinical controls *n* = 20	Case control	*Self-report* GRS	*Group differences* BD-I vs insomnia vs non-clinical controls	--	--
Gruber et al. (2009)	Community, mental health services; USA DSM-IV criteria Euthymic BD-I *n* = 27 Non-clinical controls *n* = 27	Experimental	Ruminative (immersive-why) versus reflective processing (distanced-why) task focusing on a *happy* memory	*Group differences* BD-I vs non-clinical controls *Emotion reactivity: Self-report* PANAS *Behavioural* Facial expressions *Physiological*	BD-I = controls on changes to emotion ratings across ER conditions *Confounds* BD > controls on current symptoms and comorbid anxiety. Controlling for current symptoms and comorbid anxiety did not influence relevant finding	--

				HR RSA		
Gruber et al. (2011)	Online adverts; US DSM-IV criteria Euthymic BD-I *n* = 39 Non-clinical controls *n* = 34	Experimental Case control Cross-sectional	*Self-report* RRS: Total Brooding Reflection RPA *ER manipulation* Rumination induction	*Group differences* BD-I vs non-clinical controls *Emotion reactivity: Self-report* PANAS *Physiological* HR RSA *Illness course* NIMH Life-charting	*Experimental* No group difference on emotion response to rumination manipulation (state rumination) *Confounds* Groups not matched but no group differences found on demographics. Differences remained significant when controlling for differences on current symptoms	*In BD group only* RPA subscales +ve correlated with mania frequency RRS not associated with mania frequency RRS and RPA Emotion and Self-focused Rumination +ve with depression frequency RPA Dampening not associated with depression frequency
Gruber et al. (2012)	Recruitment method unclear; USA DSM-IV criteria Euthymic BD-I and II *n* = 37 Controls *n* = 38	Experimental	*Stimuli* Film clips - happy, sad and neutral *Self-report* ERQ - spontaneous suppression and reappraisal Effort and success at ER	*Group differences* BD vs non-clinical controls *Emotion reactivity: Self-report* PANAS *Behavioural* Facial expression	*In all film conditions* BD > controls on spontaneous ERQ Reappraisal and Suppression BD = controls on emotion reactivity BD > controls on effort to regulate BD < controls on perceived success at regulating mood *Confounds* Groups not matched but checked for group differences on demographics and there were none. Did not control for group differences on current symptoms	--

Gruber et al. (2013)	Community and online – US DSM-IV criteria Euthymic BD-I *n* = 31 Euthymic UPD *n* = 21 Non-clinical controls *n* = 32	Case control using experience sampling methodology (signal-contingent, 6 days)	*Self-report* ESM items on reappraisal, calming, suppression and distraction	*Group differences* BD-I vs UPD vs non-clinical controls	--	--
Gruber et al. (2014)	Online, mental health services; USA DSM-IV criteria Euthymic BD-I *n* = 23 Non-clinical controls *n* = 23	Experimental	*ER instruction* Cognitive reappraisal *Stimuli* Films as Gruber, Harvey & Gross, 2012	*Group differences* BD-I vs non-clinical controls *Emotion: Self-report* PANAS *Behavioural* Face expression *Physiological* SCR RSA	BD-I = controls on ability to use reappraisal BD-I = controls on emotion reactivity to films – reappraisal successful at reducing emotion reactivity BD-I = controls on effort and success *Confounds* Groups not matched but no differences found on demographics. Differences on current symptoms were controlled for	--
Gul & Khan (2014)	Hospital, community; Pakistan DSM-IV criteria Euthymic BD-I *n* = 40 Non-clinical controls *n* = 40	Case control	*Self-report* ERQ		--	--

Hay et al. (2015)	Recruitment method unclear – USA DSM-IV criteria Euthymic BD-I *n* = 25 Non-clinical controls *n* = 26	Experimental	*ER instructions* Reappraisal Distraction *Stimuli* IAPS	*Group differences* BD-I vs controls *Emotion (self-report)* PANAS	BD-I = controls on emotion reactivity and ER choice – both chose distraction more regardless of intensity and valence of stimuli *Confounds* Groups not matched but did not differ on demographics. Groups differed on depression – findings did not change when controlling for this	--
Johnson et al. (2008)	University; USA DSM-IV criteria BD *n* = 28 UPD *n* = 25 Non-clinical controls *n* = 44	Case control	*Self-report* RRS: Depression Brooding Reflection RPA	*Group differences* BD vs UPD vs non-clinical controls	--	--
Johnson et al. (2016)	Online, referral; US DSM-IV criteria Euthymic BD-I *n* = 67 Non-clinical controls *n* = 58 Follow-up sample BD *n* = 36	Case control Cross-sectional and longitudinal (12 months)	*Self-report* ERQ RPA *Components found via factor analysis of emotion measures:* Positive emotion Reappraisal Suppression	*Group differences* BD-I vs non-clinical controls *Symptoms for screening and follow-up (observer-rated)* YMRS MHRSD *Functional outcomes* SPW	--	*Cross-sectional* ER strategies not correlated with manic symptoms Suppression +ve correlated with depressive symptoms *Prospective* ER strategies not correlated with QoL.BD ER strategies not correlated with manic symptoms Reappraisal –ve correlated with depressive symptoms *Confounds*

				QoL.BD		Controlled for baseline symptoms and baseline QoL in prospective analyses
Johnson & Carver (2016)	Online, community, clinical services, support groups; USA DSM-IV criteria Remitted BD-I *n* = 58	Cross-sectional	*Self-report* PUM	*Symptoms (observer-rated)* YMRS MHSRD *AQ* Verbal aggression Physical aggression Anger Hostility	--	Positive urgency +ve correlated with depressive symptoms, substance use diagnosis, and all AQ subscales Positive urgency not correlated with current manic symptoms *Regression analyses* Positive urgency predicted Verbal Aggression, Hostility, and Anger No regression analysis for Physical Aggression as only PUM correlated with this variable *Confounds* Regression analyses controlled for different variables depending on the outcome e.g. medication for verbal aggression, substance use diagnosis for Hostility
Johnson et al. (2017)	Previous studies; US DSM-IV criteria Remitted BD-I *n* = 133	Cross-sectional	*Self-report* PUM Negative urgency	*Comorbid disorders and lifetime depressive episodes (observer-rated)* SCID *Interview* Self-harm, suicide ideation and suicidal behaviour	--	*Correlations* Positive and negative urgency +ve correlated with substance/alcohol use and suicide ideation Positive, but not negative, urgency +ve correlated with past depressive episodes, suicide attempts and self-harm Negative, but not positive, urgency +ve correlated with lifetime anxiety *Regression analyses for suicide and self-harm only* Negative urgency, but not positive urgency, remained +ve associated with suicide ideation when controlling for substance use, anxiety disorders, past depressive episodes

						Positive urgency no longer associated with suicide attempts when controlling for substance use Positive urgency no longer associated with self-harm when controlling for gender and past depression *Confounds* Controlled for in regression models depending on outcome variable as above
Jones et al. (2006)	Self-help groups, clinical services, community, health staff; UK DSM-IV criteria or RDC Euthymic BD-I and II *n* = 20 Non-clinical controls *n* = 19	Case control	*Self-report* RSQ: Rumination Risk-taking Active Coping	*Group differences* BD vs non-clinical controls	--	--
Kanske et al. (2015)	Mental health services, support groups; Germany DSM-IV criteria Euthymic BD-I *n* = 22 Unaffected relatives *n* = 17 Controls for both groups *n* = 22/*n* = 17	Experimental Case control	*ER manipulation* Passive viewing, reappraisal and distraction *Stimuli* IAPS (highly arousing negative and positive images, low arousing neutral images) *Self-report* CERQ	*Group differences* BD-I vs unaffected relatives vs non-clinical controls *Emotion* *Self-report* SAM *Behavioural* fMRI scan	*Experimental* BD = controls on SAM during both reappraisal and distraction BD < controls on behavioural downregulation of affective state during reappraisal but not distraction *Confounds* Groups matched for gender, age and education Did not control for other confounds	--

Kim et al. (2012)	Outpatients, inpatients; South Korea DSM-IV criteria BD *n* = 157 UPD *n* = 227 Panic *n* = 65 Combined GAD and OCD = 27	Case control	*Self-report* RRS: Total Brooding Reflection	*Group differences* BD vs UPD vs panic disorder vs GAD/OCD	--	--
Kjærstad et al. (2016)	Outpatients and blood bank - Denmark ICD-10 criteria Remitted (partial or full) BD *n* = 20 Remitted UPD *n* = 20 Matched controls *n* = 20	Experimental Cross-sectional survey	*Social scenarios task:* *ER instruction* React naturally or dampen *Stimuli* Neutral, positive, negative social scenarios *IAPS* *ER instruction* Maintain, react or reappraise *Stimuli* IAPS - positive or neutral images *Self-report* CERQ	Self-reported emotion reactions	*Social scenarios task* BD > controls on difficulty downregulating negative reactions to negative scenarios and self-beliefs BD = controls for positive scenarios/beliefs BD = UPD *IAPS* BD = UPD and controls on emotion reactivity across ER conditions *Confounds* Groups were matched on gender and verbal IQ For both experimental paradigms, depressive symptoms, age and years of education were controlled for	--

Liu et al. (2009)	Young adults on a program project; US DSM-IV criteria Mixed mood disorder sample – childhood onset *n* = 223; BD *n* = 84	Case control	*Self-report* RSQ: Distraction Rumination	*Group differences* BD vs UPD	--	--
Muhtadie et al. (2014)	Community, outpatients; US DSM-IV criteria Euthymic BD-I *n* = 92 Controls *n* = 80	Case control Cross-sectional	*Self-report* Positive urgency Negative urgency	*Group differences* BD-I vs non-clinical controls *Functioning (observer-rated)* GAF	--	Positive Urgency –ve predicted functioning Negative Urgency did not predict functioning *Confounds* Checked a number of demographic and clinical variables and controlled for age, gender, years of education, mood symptoms, and medication
Palmier-Claus et al. (2015)	Community; UK DSM-IV criteria BD-I and BD-II *n* = 52	Cross-sectional	*Self-report* Behaviours Checklist: Ascent Behaviours Descent Behaviours	*Mood symptoms (self-report* ISS	---	Ascent behaviours partially mediated +ve association between appraisals and manic symptoms Descent behaviours predicted depression *Confounds* Controlled for age, gender, months since last depressive and manic episode, medication, hours of CBT
Park et al (2014)	From another study; US DSM-IV criteria BD *n* = 25 BD without psychosis *n* = 16 Controls *n* = 20	Experimental	*ER manipulation* Spontaneous self-distancing *Stimuli* Positive Memory Reflection Task	*Group differences* BD vs controls	BD = controls on spontaneous self-distancing *Confounds* Groups not matched Controlled for clinical and demographics including current symptoms	--

Pavlickova et al. (2013)	Service and self-help groups – UK DSM-IV criteria BD *n* = 48	Cross-sectional	*Self-report* Items from RSQ: Rumination Adaptive Coping Risk-taking	*Mood Symptoms (observer-rated)* HRSD BRMS	---	*Cross-sectional* Depression +ve associated with all RSQ subscales Mania +ve with Risk-taking but not Active Coping or Rumination
Pavlickova, Turnbull & Bentall (2014)	Self-help, clinical services, community; UK DSM-IV criteria Euthymic BD *n* = 21 Controls *n* = 23	Case control	*Self-report* RSQ: Rumination Risk-taking Active Coping	*Group differences* BD vs controls	--	--
Peckham et al. (2016a)	Web, community, outpatients; US DSM-IV criteria BD-I *n* = 90 Controls *n* = 81	Experimental	*Manipulation* Dot probe task – happy & neutral or sad & neutral faces *Self-report* RPA	*Attentional bias to positive stimuli (behavioural)* Reaction time	---	RPA Dampening –ve correlated with attentional bias for positive faces RPA Positive Rumination unrelated to attentional bias *Confounds* Checked a range of clinical and demographic confounds but none associated with outcome measure
Peckham et al. (2016b)	Part of larger study; US DSM-IV criteria Remitted BD-I *n* = 29 Non-clinical controls *n* = 28	Experimental Case control	*Stimuli* Pictures of emotional faces (happy, sad, fearful) *Self-report* RPA Dampening RRS Brooding	*Attentional bias (behavioural)* Eye tracking	--	RPA and RRS not significantly correlated with attentional bias to any emotion
Perich et al. (2011)	Other studies, community, university; Australia DSM-IV criteria	Case control	*Self-report* RSQ: Rumination Risk-taking Active Coping	*Group differences* BD vs UPD vs controls	--	--

	Euthymic BD *n* = 90 Euthymic UPD *n* = 36 Controls *n* = 66					
Perich et al. (2014)	Clinic; Australia DSM-IV criteria BD-I or II *n* = 157	Case control	*Self-report* RSQ: Rumination Risk-taking Active Coping	*Interview* History of childhood abuse	--	BD with historical physical abuse < BD without historical physical abuse on RSQ Active Coping No differences for history of sexual abuse *Confounds* Controlling for symptoms, BD with history of sexual or physical abuse = BD without a history of abuse on all RSQ subscales
Rowland et al. (2013a)	As above DSM-IV criteria BD-I *n* = 97 SZ *n* = 126 Controls *n* = 81	Case control Cross-sectional	*Self-report* CERQ	*Group differences* BD-I vs SZ BD-I vs controls *Symptoms (self-report)* HPS DASS	--	*Correlations* Depression +ve correlated with CERQ Rumination, Catastrophising, Self-blame Depression –ve correlated with CERQ Positive Reappraisal, Putting into Perspective, Refocus on Planning Anxiety, HPS and stress +ve correlated with CERQ Rumination, Catastrophising and Self-blame, Stress additionally -ve correlated with CERQ Positive Reappraisal *Regression analysis with ER strategies as simultaneous predictors* Depression +ve associated with CERQ Rumination and Acceptance Anxiety/Stress composite –ve associated with CERQ Positive Reappraisal and +ve associated with CERQ Rumination

						HPS +ve associated with CERQ Rumination and –ve associated with CERQ Acceptance *Confounds* Controlled for gender
Rowland et al. (2013b)	Research registers, clinics, community; Australia DSM-IV criteria BD-I *n* = 33 Schizophrenia (SZ) *n* = 56 Controls *n* = 58	Case control	*Self-report* CERQ	*Group differences* BD-I vs SZ BD-I vs controls	--	--
Shapero et al. (2015)	14-21 year old high school/university students; USA DSM-IV or RDC criteria Euthymic BD-I and BD-II *n* = 31 Euthymic UPD *n* = 122 Controls *n* = 228	Case control	*Self-report* RPA RRS: Brooding Reflection	*Group differences* BD vs UPD vs controls	--	--

Stange et al. (2015)	University; US DSM-IV or RDC criteria BD (not BD-I) *n* = 72	Longitudinal (average 3 years)	*Self-report* RRS: Brooding Reflection	*Depressive symptoms (self-report)* BDI *Clinical interview* Suicidal ideation	---	*Cross-sectional* RRS did not correlate with depression *Longitudinal* Controlling for lifetime suicidal ideation, interaction between self-criticism and RRS Reflection predicted suicidal ideation i.e. high reflection plus high self-criticism > suicidal ideation
Thomas et al. (2007)	Inpatients, outpatients, university; UK ICD-10 criteria Current depressed BD *n* = 14 Current manic BD *n* = 30 Remitted BD *n* = 29 Non-clinical controls *n* = 44	Case control	*Self-report* RSQ: Rumination Risk-taking Active Coping	*Group differences* Remitted BD vs currently manic BD vs currently depressed BD vs non-clinical controls	Remitted BD > controls on RSQ Rumination Manic BD > controls on RSQ Active Coping Manic BD > controls on RSQ Risk-taking All other comparisons non-significant *Confounds* Age and gender were controlled for	--
Van der Gucht et al. (2009)	Inpatients, outpatients, voluntary sector, community, university; UK DSM-IV criteria Manic BD n = 34; included mixed Depressed BD n = 30 Remitted BD n = 43	Case control Cross-sectional	*Self-report* RSQ: Rumination Risk-taking Active Coping	*Group differences* Manic BD vs depressed BD vs euthymic BD vs controls *Symptoms (observer-rated)* HSRD BRMS	--	Depressive symptoms +ve associated with RSQ Rumination Depression not correlated with RSQ Risk-taking and Active Coping No RSQ subscales correlated with manic symptoms *Confounds* Controlled for mood symptoms i.e. mania where depressive symptoms was outcome and depressive symptoms where manic symptoms was outcome

	Controls n = 41					
Van Meter & Youngstrom (2016)	Young adults on research database; US DSM-IV criteria Euthymic BD (I & II) *n* = 23 UPD *n* = 21	Case control	*Self-report* CERQ	*Group differences* BD vs UPD	--	--
Victor, Johnson & Gotlib (2011)	Part of larger study; US DSM-IV criteria BD-I *n* = 76	Cross-sectional	*Self-report* PUM	*Quality of life (self-report)* QoL.BD	---	PUM –ve correlated with QoL *Confounds* Controlling for further confounding variables and comorbid diagnoses PUM -ve associated with QoL
Wolkenstein, Zwick, Hautzinger, and Joormann (2014)	Outpatients, community; Germany DSM-IV criteria Euthymic BD-I or II *n* = 42 Euthymic UPD *n* = 43 Controls *n* = 39	Cross-sectional Case control	*Self-report* CERQ	*Group differences* BD vs UPD vs controls *Symptoms (self-report)* QIDS SMRI	--	Depression +ve correlated with CERQ Blaming Others and –ve correlated with CERQ Acceptance Mania +ve correlated with CERQ Self-blame All other correlations between CERQ subscales and symptoms were non-significant

AQ = Aggression Questionnaire; ASRM = Altman Self-Rating Mania Scale; BDI = Beck Depression Inventory; CERQ = Cognitive Emotion Regulation Questionnaire; DASS = Depression Anxiety Stress Scales; HAM-A = Hamilton-Anxiety Rating Scale; HAM-D = Hamilton Depression Rating Scale; HMI = Halberstadt Mania Inventory; GAF = Global Assessment of Functioning; GRS = Global Rumination Scale; HR = Heart Rate; HPS = Hypomanic Personality Scale; IDDL = Inventory to Diagnose Depression - Lifetime; IAPS = International Affective Picture System; ISS = Internal States Scale; LESS = Leahy

Emotional Schema Scale; MHSRD = Modified Hamilton Depression Rating Scale; MDQ = Mood Disorders Questionnaire; PANAS = Positive and Negative Affect Schedule; PUM = Positive Urgency Measure; QIDS = Quick Inventory for Depressive Symptomatology; QoL.BD = Quality of Life in Bipolar questionnaire; RPA = Responses to Positive Affect; RRI = Reward Responses Inventory; RRS = Ruminative Responses Scale; RRQ = Reflection-Rumination Questionnaire; RSA = respiratory sinus arrhythmia; RSQ = Response Styles Questionnaire; SAM - Self Assessment Manikin; SMRI = Self-report Manic Inventory; SADS = Schedule for Affective Disorders and Schizophrenia; SCID = Structured Clinical Interview for the DSM-IV; SCR = Skin Conductance Response; SPW = Scale of Psychological Well-being; YMRS = Young Mania Rating Scale

Table 3: Summary of key findings of case control studies using self-report ER measures

ER strategy	**Regulating negative emotions & depression**						
	BD > HC	**BD < HC**	**BD = HC**	**BD > UPD**	**BD < UPD**	**BD = UPD**	**Other clinical groups**
Suppression	Gruber et al. (2013) Gul & Khan (2014)	--	Johnson et al. (2016)	--	--	Gruber et al. (2013)	--
Negative rumination	Alloy et al. (2009) Batmaz et al. (2014) Green et al. (2011) Gruber et al. (2008) Gruber et al. (2011) Jones et al. (2006) Kanske et al. (2015) Kjærstad et al. (2016) Pavlickova et al. (2014) Peckham et al. (2016b)**	--	Thomas et al (2007) = manic and depressed BD	Kim et al. (2012)* Shapero et al. (2015)*	--	Batmaz et al. (2014) Fletcher et al. (2013) Johnson et al. (2008) Kim et al. (2012)** Kjærstad et al. (2016) Liu et al. (2009) Perich et al. (2011) Shapero et al. (2015)** Van Meter and Youngstrom (2016)	BD > SZ Rowland et al. (2013a) BD = SZ Rowland et al. (2013b) BD = BPD Bayes et al. (2016) Fletcher et al. (2014) BD = insomnia

	Perich et al. (2011) Rowland et al. (2013a) Rowland et al. (2013b) Thomas et al. (2007) – remitted only Van der Gucht et al. (2009) Wolkenstein et al. (2014)					Wolkenstein et al. (2014)	Gruber et al. (2008) BD > panic disorder Kim et al. (2012) BD > GAD/OCD Kim et al. (2012)* BD = GAD/OCD Kim et al. (2012) – total and brooding
Risk-taking	Jones et al. (2006) Pavlickova et al. (2014) Thomas et al. (2007) – manic BD Van der Gucht et al. (2009) – manic	--	Perich et al. (2011) Thomas et al. (2007) – euthymic and depressed BD Van der Gucht et al. (2009) - euthymic/depressed	Fletcher et al. (2013)	--	Liu et al. (2009) Perich et al. (2011)	--
Negative urgency	Muhtadie et al. (2014)	--	--	--	--	--	--

Catastrophising	Green et al. (2011) Kanske et al. (2015) Kjærstad et al. (2016) Rowland et al. (2013a) Rowland et al. (2013b) Wolkenstein et al. (2014)	--	--	--	--	Fletcher et al. (2013) Kjærstad et al. (2016) Van Meter and Youngstrom (2016) Wolkenstein et al. (2014)	BD = SZ Rowland et al. (2013a) Rowland et al. (2013b) BD < BPD Fletcher et al. (2014a) Bayes et al (2016)
Self-blame	Green et al. (2011) Kanske et al. (2015) Kjærstad et al. (2016) Rowland et al. (2013b) Rowland et al. (2013a) Wolkenstein et al. (2014)	--	--	--	--	Fletcher et al. (2013) Kjærstad et al. (2016) Van Meter and Youngstrom (2016) Wolkenstein et al. (2014)	BD > SZ Rowland et al. (2013a) Rowland et al. (2013b) BD < BPD Fletcher et al. (2014a) Bayes et al (2016)

Blaming others	--	--	Green et al. (2011) Kanske et al. (2015) Kjærstad et al. (2016) Rowland et al. (2013b) Rowland et al. (2013a) Wolkenstein et al. (2014)	--	--	Fletcher et al. (2013) Kjærstad et al. (2016) Van Meter & Youngstrom (2016) Wolkenstein et al. (2014)	BD < SZ Rowland et al. (2013b) BD = SZ Rowland et al. (2013a) BD < BPD Fletcher et al. (2014a) BD = BPD Bayes et al. (2016)
Active coping	Thomas et al. (2007) – manic Gruber et al. (2013)	Pavlickova et al. (2014) Perich et al. (2011)	Alloy et al. (2009) Jones et al. (2006) Thomas et al. (2007) – remitted and depressed Van der Gucht et al. (2009)	--	--	Fletcher et al. (2013) Gruber et al. (2013) Liu et al. (2009) Perich et al. (2011)	--

Reappraisal	--	Gul and Khan (2014) Johnson et al. (2016) Kanske et al. (2015) – controls only Rowland et al. (2013b) Wolkenstein et al. (2014)	Green et al. (2011) Gruber et al. (2013) Kanske et al. (2015) – relatives only Kjærstad et al. (2016) Rowland et al. (2013a)	--	--	Fletcher et al (2013) Gruber et al. (2013) Kjærstad et al. (2016) Van Meter and Youngstrom (2016) Wolkenstein et al. (2014)	BD = SZ Rowland et al. (2013a) Rowland et al. (2013b) BD > BPD Fletcher et al. (2014a) Bayes et al. (2016)
Refocus on planning	--	--	Green et al. (2011) Kanske et al. (2015) Kjærstad et al. (2016) Rowland et al. (2013a) Rowland et al. (2013b) Wolkenstein et al. (2014)	--	--	Fletcher et al (2013) Kjærstad et al. (2016) Van Meter & Youngstrom (2016) Wolkenstein et al. (2014)	BD = SZ Rowland et al. (2013a) Rowland et al. (2013b) BD > BPD Fletcher et al. (2014a) BD = BPD

							Bayes et al. (2016)
Positive refocusing	--	--	Green et al. (2011) Kanske et al. (2015) Kjærstad et al. (2016) Rowland et al. (2013a) Rowland et al. (2013b) Wolkenstein et al. (2014)	--	--	Fletcher et al (2013) Kjærstad et al. (2016) Van Meter & Youngstrom (2016) Wolkenstein et al. (2014)	BD = SZ Rowland et al. (2013a) Rowland et al. (2013b) BD = BPD Fletcher et al. (2014) Bayes et al. (2016)
Putting into perspective	--	Green et al. (2011) – relatives only Rowland et al. (2013a) Wolkenstein et al. (2014)	Green et al. (2011) – controls only Kanske et al. (2015) Kjærstad et al. (2016) Rowland, Hamilton, Vella, et al. (2013)	--	--	Fletcher et al. (2013) Kjærstad et al. (2016) Van Meter and Youngstrom (2016) Wolkenstein et al. (2014)	BD < SZ Rowland et al. (2013a) BD = SZ Rowland et al. (2013b) BD > BPD

							Fletcher et al. (2014a) Bayes et al (2016)
Acceptance	--	--	Green et al. (2011) Kanske et al. (2015) Kjærstad et al. (2016) Rowland et al. (2013a) Rowland et al. (2013b) Wolkenstein et al. (2014)	--	--	Fletcher et al (2013) Kjærstad et al. (2016) Van Meter & Youngstrom (2016) Wolkenstein et al. (2014)	BD = SZ Rowland et al. (2013a) Rowland et al. (2013b) BD = BPD Fletcher et al. (2014a) Bayes et al. (2016)
ER strategy	**Regulating positive emotion & mania**						
	BD > HC	**BD < HC**	**BD = HC**	**BD > UPD**	**BD < UPD**	**BD = UPD**	**Other**
Dampening	Edge et al. (2013) Gruber et al. (2011) Johnson et al. (2016)	--	--	Shapero et al. (2015)	--	Fletcher et al. (2013) Gilbert et al. (2013) Johnson et al. (2008)	--

	Peckham et al. (2016b) Shapero et al. (2015)						
Reward avoidance	Edge et al. (2013)	--	--	--	--	--	--
Positive rumination	Johnson et al. (2008)*** Johnson et al. (2016) – overall but not emotion-focused/self-focused separately Shapero et al. (2015)*** Gruber et al. (2011)****	--	Edge et al. (2013) Gruber et al. (2011)*** Johnson et al. (2008)**** Johnson et al. (2016) – for emotion-focused and self-focused separately Shapero et al. (2015)****	Fletcher et al. (2013) Johnson et al. (2008)*** Shapero et al. (2015)***	--	Gilbert et al. (2013) Johnson et al. (2008)**** Shapero et al. (2015)****	
Positive urgency	Muhtadie et al. (2014)	--	--	--	--	--	--

*reflective rumination only **brooding only *** emotion-focused rumination only ****self-focused rumination only

Note: Green et al (2013) and Kanske et al (2013) had two non-clinical control groups – non-relatives and unaffected relatives. We have specified where there is divergence between these two control groups in comparisons with BD.