

Abstract

Background: Research into bipolar disorder (BD) has primarily focused upon clinical recovery (CR), i.e. symptom reduction, and overlooked personally meaningful recovery outcomes emphasized by service users. Personal recovery (PR) has been a major focus in the formulation of mental health policies and guidelines, and yet, research into factors influencing PR in BD is in its infancy. **Methods:** This study compared psychological associates of concurrent PR and CR, and determined psychological factors in PR prospectively at 6 months. **Results:** 107 participants completed baseline assessments, of whom 84% completed follow-up at 6 months. Controlling for potential confounders, multiple linear and ordinal regression models showed that some psychological factors underpinned both CR and PR at baseline: worse PR and CR outcomes were associated with higher negative self-dispositional appraisals and dysfunctional attitudes. Better PR, but worse CR ([hypo]mania related) were associated with higher adaptive coping. Additionally, better PR (but not CR) was associated with higher concurrent risk taking at baseline and predicted at follow-up by higher levels of baseline rumination. Better CR ([hypo]mania related), but not PR, was associated with lower impulsivity, but higher BAS processes. **Limitations:** Psychological and clinical factors were not measured at follow up and may have changed over time. Participants were a convenience sample. **Conclusions:** Understanding psychological factors driving recovery in BD is essential for refining the conceptual framework of PR, and informing psychological models and related interventions for BD. The identified differences in psychological factors highlight the importance of more individualised, PR focused therapeutic approaches.

Keywords: bipolar disorder; personal recovery; clinical recovery; psychological factors; coping

Introduction

Clinical recovery (CR)¹ in bipolar disorder (BD), has typically been defined as symptom resolution and relapse prevention. Service users, in contrast, often define recovery as a process, rather than an outcome, and emphasize the importance of hope and empowerment (Leamy et al., 2011). While important, CR overlooks the subjective unique experiences of service users, captured by personal recovery (PR) (Jones et al., 2013). There may be overlap between CR and PR, but they exhibit different trajectories (Andresen et al., 2010; Tse et al., 2014a) so a sole focus on CR provides a partial picture of the effectiveness of mental health treatments (Gitlin and Miklowitz, 2017). Consequently, there is increased interest in PR in mental health policies and guidelines internationally requiring services to focus on personally meaningful outcomes highlighted by service users (Department of Health, 2011; Mental Health Commission of Canada, 2012; New Freedom Commission on Mental Health, 2003; NICE, 2014). Despite this research has primarily focused on CR and overlooked PR, especially in BD.

Research on PR primarily focused on the conceptualisation of recovery in mental health (for review, see Leamy et al., 2011) as opposed to underlying psychological factors. For instance, the widely adopted CHIME framework- for PR in mental health proposed five key PR processes: Connectedness, Hope and optimism about the future, Identity, Meaning in life, and Empowerment (Leamy et al., 2011). CHIME is focused on the conceptualisation of PR in severe mental health problems in general; psychological factors underpinning PR in BD specifically, were not considered. It is important to investigate psychological factors in PR in BD separately, since patterns of thinking that may usually indicate improvement in mental health, such as optimism, may indicate deterioration in BD (Jones et al., 2013).

¹ CR: Clinical Recovery, BD: Bipolar Disorder, PR: Personal Recovery

Research considering psychological factors in PR is in its infancy, and has primarily focused on psychosis and schizophrenia. For instance, a recent longitudinal study exploring psychological predictors of PR found that less negative beliefs about self and hopelessness along with higher self-esteem were stronger predictors of PR than psychotic symptoms or functioning (Law et al., 2016). Other research has focused on factors incorporated in the CHIME model, such as hope in relation to PR in psychosis (Lim et al., 2019). However, based upon the model these factors are components of PR as opposed to psychological correlates/predictors of PR (Leamy et al., 2011).

With regard to BD, to date, there has been no prospective research on the impact of psychological factors on PR. One cross-sectional study explicitly examined psychological correlates of PR in BD and found negative illness models (thoughts about uncontrollable mood swings) were linked to worse PR (Dodd et al., 2017). Other cross-sectional associates of PR in BD include social (i.e. discrimination and social support; Dunne et al., 2019; Grover et al., 2016) demographic (i.e. age and employment; Dodd et al., 2017; Tse et al., 2014b) functional (Grover et al., 2016; Jones et al., 2013; Tse et al., 2014b) and symptomatic factors (i.e. depressive symptoms; Dodd et al., 2017). No other research focused on psychological factors in PR in BD.

While CR and PR seem to follow different trajectories, indicating that they are not synonymous (Andresen et al., 2010; Macpherson et al., 2016), they are at least partially linked and sense making processes seem to underpin both PR and CR (Leonhardt et al., 2017), highlighting the importance of psychological factors in both recovery outcomes. Established research has demonstrated the importance of a number of key psychological factors in BD that have been linked to risk of onset and relapse into acute mood episodes in individuals with BD in euthymic states, so impacting on CR outcomes. We therefore chose to

examine these to evaluate the extent to which they underpin PR to indicate whether alternative models are necessary for PR.

Psychological models of BD

We selected psychological factors for the present study based upon the psychological models in BD that have been most extensively researched and supported by well-established evidence base: the Cognitive Vulnerability Model, the Response Style Theory and the Behavioural Activation System (BAS) Dysregulation Model. Table 1 presents a brief review of these models and their links to CR, including depressive and (hypo)manic symptomatology and episodes.

The Cognitive Vulnerability Model and Response Style Theory are extended from theories of unipolar depression. The former proposes that maladaptive and dysfunctional cognitive styles and information processing (dysfunctional attitudes and negative appraisals) contribute to bipolar vulnerability (Abramson et al., 1989; Alloy et al., 2005; Beck, 1967; Reilly-Harrington et al., 1999). The latter proposes that response styles to depressed mood (rumination, adaptive coping or risk taking) are linked to episodes and increased symptomatology in BD (Knowles et al., 2005; Nolen-Hoeksema, 1991, 2000; Roberts et al., 1998).

The BAS Dysregulation Model presents two complementary systems the behavioural activation system (BAS) activated by rewards and incentives and behavioural inhibition system (BIS) activated by punishment or threat and proposes that the dysregulation of the BAS system contributes to BD (Alloy and Abramson, 2010; Alloy et al., 2009a; Corr, 2001; Depue and Collins, 1999; Depue and Iacono, 1989; Gray, 1982). It has been suggested that impulsivity is related to, but distinct from, BAS processes, i.e. reward responsiveness (Smillie et al., 2006).

Table 1. Summary of the core psychological models in BD and their links to CR outcomes

	Cognitive vulnerability	Response style theory	The behaviour activation system (BAS) dysregulation model
Explanation for depressive episodes	Maladaptive and self-referential negative cognitive styles are activated by negative and stressful life events.	Rumination (directing one's attention to one's negative affective state) contributes to depressive symptoms and episodes.	Low BAS activation results in low energy, anhedonia, disengagement and leads to depression.
Explanation for manic episodes	1) Positive life events activate positive cognitive styles. 2) Negative cognitive styles contribute to both episode polarities. Manic defence hypothesis: mania arises as a defence mechanism, dysfunctional attempt to avoid depression and negative cognitive styles. (Abraham, 1911/1927; Neale, 1988).	1) Depression avoidance hypothesis: risk taking and extreme distractive behaviour as attempts to avoid negative mood, result in (hypo)mania (Thomas and Bentall, 2002). 2) Rumination as response to positive affect intensifies mood (Feldman et al., 2008; Gilbert et al., 2013; Johnson et al., 2008b)	Increased BAS activity (triggered by goal attainment life events) contributes to irritability, goal-directed activity, decreased sleep, increased self-confidence and contributes to manic episodes.
Evidence and strength	1) Similar cognitive styles in individuals with unipolar depression and current bipolar depression (both more negative than typical population), including low self-esteem, self-referent information processing, dysfunctional attitudes and attributional styles (Jones et al., 2005; Lam et al., 2004; Reilly-Harrington et al., 1999). 2) Self-referential and dysfunctional information processing triggered by life events is present in BD and contributes to the escalation of depressive and hypomanic symptomatology. (Alloy et al., 1999; Fletcher et al.; Lam et al., 2010; Perich et al., 2011; Reilly-Harrington et al., 1999).	1) Rumination predicted the onset and severity of depression in unipolar patients and bipolar individuals showed similar ruminative response style to unipolar individuals (Just and Alloy, 1997). 2) Rumination was found to be present in mania, depression and remission (Van der Gucht et al., 2009) 2) Higher rumination was identified in all mood states of bipolar individuals compared to normal controls. High levels of self-reported adaptive coping and risk-taking found in manic states compared to normal controls (Silveira Jr and Kauer-Sant'Anna, 2015; Thomas et al., 2007; Van der Gucht et al., 2009).	1) Elevated BAS score on self-reported measures in individuals with BD and high-risk population compared to healthy control (Alloy et al., 2006; Meyer et al., 1999; Meyer et al., 2001b) and unipolar depression (Quilty et al., 2014). Higher BAS sensitivity was found in all mood states (Alloy et al., 2008; Salavert et al., 2007; Urošević et al., 2008). 2) BAS relevant cognitive styles (goal striving, perfectionism and autonomy) identified in individuals within the bipolar spectrum (Alloy et al., 2009b; Lam et al., 2004; Scott et al., 2000). 3) BAS triggering life events (goal striving or attainment) contribute to increased manic symptomology (Alloy et al., 2006; Johnson et al., 2008a; Nusslock et al., 2007).

Cognitive vulnerability	Response style theory	The behaviour activation system (BAS) dysregulation model
Limitations	<p>3) Rumination was associated and prospectively predicted depressive mood, risk taking was associated with both elevated and depressive mood, and adaptive coping with elevated mood (Knowles et al., 2005; Pavlickova et al., 2013; Thomas et al., 2007).</p>	<p>4) Neurophysiological and imagining evidence for BAS relevant brain activity (Alloy et al., 2015; Coan and Allen, 2004).</p> <p>5) Provides a single underlying mechanism that explains both poles (Alloy et al., 2015).</p> <p>6) Impulsivity has been proposed as a key feature in BD and linked to more severe course and outcomes (Henna et al., 2013; Najt et al., 2007; Swann et al., 2009).</p>
<p>1) Inconsistent results for explaining (hypo)manic episodes: varied findings for the manic-defence hypothesis (Bentall and Thompson, 1990; Johnson and Fingerhut, 2004; Thompson and Bentall, 1990).</p> <p>2) Inconsistent results regarding euthymic states: no difference between individuals in remitted state and normal controls in self-esteem, dysfunctional attitudes, attributional styles and self-referent information processing (Pardoen et al., 1993; Reilly-Harrington et al., 1999) vs. finding higher self-esteem, more negative attributional styles and dysfunctional attitudes compared to controls (Lam et al., 2005; Scott et al., 2000; Van der Gucht et al., 2009; Winters and Neale, 1985; Wright et al., 2005).</p> <p>3) Inconsistent results regarding mood state dependence (Alloy et al., 1999; Scott and Pope, 2003).</p> <p>3) No explanation for mixed episodes.</p>	<p>1) Primary research focus on unipolar depression and rumination. Lack of research on long-term effects of response styles in BD.</p> <p>2) No explanation for mixed episodes.</p>	<p>1) Inconsistent results regarding negative life events reducing BAS activation and in turn leading to depressive episodes (Hammen and Gitlin, 1997; Hunt et al., 1992; Johnson et al., 1999; Malkoff-Schwartz et al., 1998; Swendsen and Gitlin, 1995).</p> <p>2) No explanation for mixed episodes.</p>

As outlined in Table 1, each model has limitations. More recent and integrated models can overcome some of the limitations by proposing multilevel information-processing systems that can result in conflicting interpretations and responses to changes in internal states and so provide an explanation for mixed episodes (Jones, 2001; Mansell et al., 2007). However, as this study is the first to compare the psychological correlates of CR and PR we focused on the most widely researched psychological models. Moreover, such integrated models also include elements of the psychological factors evaluated in the present study, i.e. appraisal of physiological experiences, such as self-referential appraisals of mania and depression.

The present study

Bipolar-relevant psychological factors have been shown to be elevated in individuals with BD and influence CR outcomes (see Table 1), but their role in PR is currently unknown and has been overlooked. This important omission has also been highlighted by a recent scoping review of systematic reviews in PR that has identified the need for focusing on the underpinning mechanisms of PR and adapting the CHIME conceptual framework to the population characteristics, especially focusing on populations with mood disorders (van Weeghel et al., 2019).

The study's main focus is on cross-sectional and longitudinal associations between BD-relevant psychological factors and PR (primary outcome) to address this gap in the literature. We also investigated if our cross-sectional findings were similar to previous research findings on psychological factors in CR (secondary outcome). Based on service user feedback we prioritised retention and minimised burden on participants by limiting follow-up assessment to PR data.

Psychological measures were selected to tap psychological factors relevant to each of these theories. At baseline we evaluated associations (and their similarities and difference) between bipolar specific psychological factors and PR and CR respectively adjusting for clinical and demographic factors. We then explored how well baseline psychological factors (adjusting for clinical and demographic factors) predicted PR at 6 months follow-up. Developing a theoretical model for understanding the psychological factors in PR in BD is important to inform: (a) refinement of the key psychological models of BD; (b) extension of the PR conceptual framework and (c) future recovery-focused research and psychological therapies for BD.

Methods

Design

An exploratory quantitative (cross-sectional and longitudinal) research design was used. Previous research in PR primarily focused on the conceptualisation as opposed to the complex underlying factors of PR and so did not provide sufficient theoretical justification for hypothesis testing. This design is an inductive approach to generate theories, as opposed to testing hypotheses deriving from theories (Bryman, 2016).

Participants

A convenience sample was recruited from: (a) NHS Mental Health Services in Northwest England; (b) social media and flyers; (c) Bipolar UK Charity and (d) a University Department panel of individuals interested in research. Inclusion criteria: (a) primary research diagnosis of BD (I or II), confirmed using Structured Clinical Interview for DSM-IV (SCID) (First et al., 2002); (b) aged ≥ 18 years; (c) UK resident with sufficient English fluency to understand the study requirements and (d) having capacity to consent, confirmed using the flowchart of Nicholson, Cutter and Hotopf (Nicholson et al., 2008). Exclusion criteria: (a) in

current episode and/ under a section of the Mental Health Act; or (b) current suicidal behaviour or primary alcohol / drug problems.

Measures

Primary outcome: personal recovery. *Bipolar Recovery Questionnaire* (Jones et al., 2013). This tool has 36 items scored on 0-100 visual analogue scales ranging from ‘strongly disagree’ (0) to ‘strongly agree’ (100). Higher BRQ scores indicate a higher self-rated PR. Cronbach’s alpha was (α) = 0.91 at baseline. BRQ is sensitive to change (Jones et al., 2018; Jones et al., 2015).

Secondary outcomes: (hypo)manic and depressive episodes. The number of (hypo)manic and depressive episodes (separately) were used to operationalise CR. This represents a long-term cumulative clinical outcome (number of times when CR has been achieved after an acute episode). Participants were recruited in a euthymic state to minimise the impact of acute episodes on self-reported measures. Therefore, using a symptom measure to indicate CR would have been problematic due to potential floor effect. SCID (First et al., 2002) was used to establish the number of depressive and (hypo)manic episodes . Episode counts were categorised, based upon previous literature (Morriss et al., 2016) to form ordinal variables for both (hypo)manic and depressive episodes (‘1’ = <7, ‘2’ = 8-19, ‘3’ \geq 20 episodes).

SCID interviews were conducted by a trained interviewer (BM) to verify BD diagnosis and to screen out individuals in current episode/suicidal behaviour. SCID is considered the gold standard for confirming research diagnosis (Lobbestael et al., 2011).

Demographic and clinical information. A *demographic/clinical questionnaire* was used to collect information listed in Table 2 and 3. Employment, residential and

relationship statuses were dichotomised; education ('primary', 'further' and 'higher') and number of hospitalisation ('0', '1-6', ' ≥ 7 ') were assessed on ordinal scales.

Symptom measures. *Center for Epidemiologic Studies: Depression Scale (CES-D; Radloff, 1977)*. This assesses depressive symptoms over the previous week across 20 items, rated on 4-point Likert scales. Higher scores indicate higher levels of depressive symptomology. Cronbach's alpha was $\alpha = 0.87$.

Altman Mania Rating Scale (AMRS; Altman et al., 1997). AMRS assesses (hypo)manic symptoms during the past week across five items on a five-point scale. Higher scores indicate more (hypo)manic symptoms. Cronbach's alpha was $\alpha = 0.82$.

Interpretation of Depression Questionnaire (IDQ-E; Jones and Day, 2008)) and the Hypomania Interpretation Questionnaire (HIQ-E; Jones et al., 2006). See psychological factors section for more detail. Ten-item yes/no 'Experience' subscales were used to assess depression- or hypomania-relevant experiences in the preceding 3 months. Higher scores indicate more symptom experiences. Cronbach's alpha was $\alpha = 0.90$ for IDQ-E and $\alpha = 0.94$ for HIQ-E.

Psychological factors. *Cognitive Vulnerability Model. Interpretation of Depression Questionnaire and Hypomania Interpretation Questionnaire (IDQ and HIQ; Jones and Day, 2008; Jones et al., 2006)*. HIQ has two subscales to evaluate (a) positive self-appraisals (HIQ-H) and (b) normalising appraisals (HIQ-N) of the same hypomania-related experiences (10 items); each scored on four-point Likert scales. The IDQ similarly measures negative self-dispositional (IDQ-D) and normalising appraisals (IDQ-N) for depression-related experiences. Higher scores indicate stronger appraisals. Cronbach's alpha was: HIQ-H: $\alpha = 0.88$, HIQ-N: $\alpha = 0.85$, IDQ-D: $\alpha = 0.91$, and IDQ-N: $\alpha = 0.89$.

Dysfunctional Attitude Scale (DAS-24; Lam et al., 2004). DAS-24 measures dysfunctional attitudes (total score) over 24 items assessed on seven-point Likert scales; higher values indicate higher levels of dysfunctional attitudes. Cronbach's alpha was $\alpha = 0.92$.

Response Style Theory. *Response Style Questionnaire (RSQ) revised version (Knowles et al., 2005).* RSQ measures response styles to negative mood on 3 subscales incorporating 48 items: rumination (RSQ-R; 25), risk taking (RSQ-RT; 8) and adaptive coping (RSQ-AC; 15); all rated on 4-point Likert scales (0-3). Higher scores indicate higher rates of response styles. Cronbach's alpha was RSQ-R: $\alpha = 0.89$, RSQ-RT $\alpha = 0.70$ and RSQ-AC: $\alpha = 0.91$ for AC.

Behavioural Activation System (BAS) Dysregulation Model. *The BIS/BAS Inventory (Carver and White, 1994).* The scale appraises the sensitivity of the behavioural inhibition and activation systems. The BAS scale (total score) was used consisting of 3 subscales (reward responsiveness, drive and fun-seeking) over 13 items evaluated on four-point Likert-scales. Both BAS subscales and the total score have been linked to (hypo)manic symptomology and episodes (Johnson et al., 2012). Higher total score (BAS-T) indicates higher BAS, Cronbach's alpha was $\alpha = 0.89$.

Barratt Impulsiveness Scale (BIMP; Patton and Stanford, 1995). BIMP assesses impulsivity across 30 items rated on four-point Likert scales. The total score was used (IMP-T), higher scores indicate higher levels of impulsivity; Cronbach's alpha was $\alpha = 0.82$.

Procedure

A service User Advisory Panel was consulted about the procedure of the study. The study ('Understanding Personal Recovery in Bipolar Disorder'; Ref: 14/LO/1170) was approved by the London – Queen Square UK NHS Research Ethics Committee. Participants

provided informed written consent before taking part in this study. Following informed consent participants completed a telephone SCID interview and baseline questionnaires online or on paper. At their follow-up assessment 6 months later they completed, a SCID interview update (to check for acute episodes) and the BRQ.

Sample Size

A series of power calculations were performed to estimate the target sample size using nQuery Advisor® + nTerim 2.0 programme. Assuming a linear regression model and 30 predictors (variables), the calculations suggested that a sample size varying from 63 to 122 would be required, depending on the assumed total explained variance (varying between 20% to 40%), while setting Power, at 0.8 and the significance level at 5% (two-sided). Based upon an assumed total explained variation of 25% we required 98 participants. However, to allow for some attrition we increased the entry target to 122 participants, based upon a conservative 20% in explained variation.

Data analysis

All data analyses used SPSS version 21.

Missing data and imputation. Online questionnaire items were forced response to minimise missing data. Participants with > 50% missing items on any subscale were excluded. When < 50% of items on any subscale were missing, multiple regression models (single imputation) were used for data imputation. Factors entering the imputation models were the completed items of the same subscale. Sensitivity analysis explored any difference between complete case and the imputed dataset results.

Descriptive statistics. Continuous variables were described by mean, standard deviation, and range; categorical and ordinal variables by frequencies and percentages.

Cross-sectional analysis. Starting with, saturated ‘main effects’ models (see Table S3., supplementary materials) including demographic, clinical and psychological factors, backward stepwise multiple linear regression models (based on F-statistic) determined significant factors explaining BRQ total score variance. Backward stepwise ordinal regression models (based on Wald statistic) determined factors explaining the variance in CR (two ordinal variables created from the number of (a) depressive and (b) (hypo)manic episodes at baseline). Statistical significance required a two-sided p-value of $<.05$. Forwards selection and backwards elimination procedures were contrasted to gauge selection procedure sensitivity. Bivariate associations between the modelled factors and outcomes were conducted for data exploration.

Longitudinal data analysis. Change in the BRQ Total score (follow-up – baseline) was the outcome variable in the prospective analysis. Similarly to baseline PR modelling, backward stepwise multiple linear regression models were used to determine predictors of BRQ change scores. Baseline BRQ scores were included to control for regression to the mean and to improve efficiency.

Results

Participant attrition and missing data

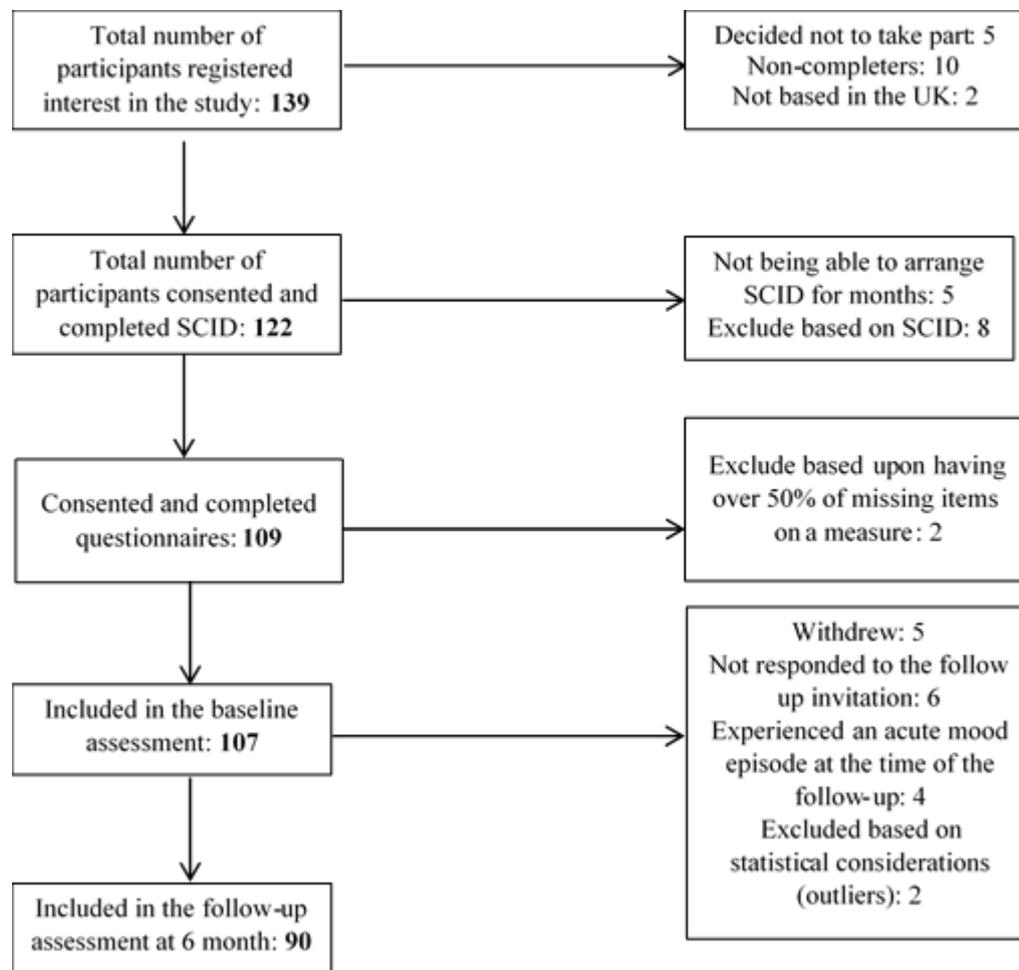


Figure 1. Flowchart illustrating the recruitment, screening and retention of study participants

107 participants at baseline were recruited via: University panel (51%), Bipolar UK Charity (31%), Mental Health Service Referrals (10%), and direct advertising (8%) (See Figure 1).

Ninety participants were retained at 6-month follow-up. Missing items only occurred on paper questionnaires and were minimal (0.06%).

Descriptive statistics

Table 2. Number and percentage of participants falling in each level of the categorical clinical and demographic variables

Variable	Number	Percentage
Gender		
Female	66	61.7
Male	41	38.3
Relationship status		
Single	56	52.3
In relationship	51	47.7
Residential status		
Alone	42	39.3
With others*	65	60.7
Highest education		
Primary or secondary	13	12.1
Further	25	23.4
Higher	69	64.5
Employment status		
Employed	80	74.8
Unemployed	27	25.2
Number of hospitalisations		
0	36	33.6
1-6	62	57.9
≥ 7	9	8.4
SCID based BD diagnosis		
BD-I	76	71
BD-II	30	28
BD-NOS	1	1
Number of depressive episodes		
0-7	28	26.2
8-19	19	17.8
≥ 20	60	56.1
Number of (hypo)manic episodes		
1-7	44	41.1
8-19	19	17.8
≥ 20	44	41.1

Table 3. Mean, standard deviation (SD) and range of the recorded values of the continuous clinical, demographic and psychological factors

Variable	Mean	SD	Range
Age	46.13	10.97	23-77
Age of onset	17.55	8.22	4-49
Time since first episode (years)	28.57	11.85	3-64
CES-D	19.04	11.94	0-51
AMRS	4.72	4.24	0-19
HIQ-E	5.42	3.95	0-10
IDQ-E	6.65	3.44	0-10
HIQ-H	24.96	7.79	10-40
HIQ-N	24.34	6.90	10-38
IDQ-D	19.49	7.45	10-36
IDQ-N	27.19	6.84	10-40
RSQ-R	34.07	12.00	11-67
RSQ-AC	17.89	9.08	0-42
RSQ-RT	2.92	2.91	0-16
DAS-24	94.45	27.40	37-161
BAS-T	38.74	7.34	20-52
IMP-T	67.61	11.07	43-105

AMRS: Altman Mania Rating Scale; BAS-T: Behavioural Approach System-Total Score; CES-D: Center for Epidemiologic Studies: Depression Scale; DAS-24: Dysfunctional Attitudes Scale- Total score; IDQ: Interpretation of Depression Questionnaire (E: Experience, N: Normalising; D: Negative self-dispositional appraisal subscales); HIQ: Hypomania Interpretation Questionnaire (E: Experience, N: Normalising; H: Positive self-dispositional appraisal subscales); IMP-T: Barratt Impulsiveness Scale-Total score; RSQ: Response Style Questionnaire (R: Rumination, AC: Adaptive Coping, RT: Risk taking subscales).

Demographic and clinical factors (see Tables 2 and 3). Most participants were female (62%), single (52%), but not living alone (61%). Participants reported high occupational functioning: 65% educated to university degree level and 75% were employed/meaningfully occupied. Mean age of BD onset was in line with the literature (Baldessarini et al., 2012). The sample had a chronic BD course, mean duration almost 30 years, many reporting over 20 depressive and/or (hypo)manic episodes.

CES-D was above the clinical threshold for a depressed episode (Radloff, 1977), whereas the ARMS mania score was below (Altman et al., 1997). Means for psychological measures and PR were comparable to those reported in the scale development/validation papers (cited above). Participants had higher rumination than previously reported in euthymia (Thomas et al., 2007; Van der Gucht et al., 2009). Mood and psychological measures correlations were consistent with previous literature (see Table S.1. supplementary materials).

Cross-sectional results (see Table 4 and Table S.3)

PR. Seven factors explained 55.7% of the variance in baseline PR (Adjusted $R^2 = .557$, $F(7, 99) = 20.058$, $p < .001$). Females, participants in a relationship, and individuals with higher adaptive coping and risk taking reported higher PR at baseline. More depressive symptoms, dysfunctional attitudes and negative self-dispositional appraisals were associated with lower PR at baseline. Psychological factors contributed 20.4% to variance explained, whereas, demographic and clinical factors contributed 35.3%.

CR- Depressive Episodes. Three factors explained 26.3% of variance in number of depressive episodes at baseline (Nagelkerke's $R^2 = .263$, $X^2(3) = 27.04$, $p < .001$). Longer time since first episode, higher depressive symptoms and negative self-dispositional appraisals were associated with more depressive episodes. Negative self-dispositional appraisals explained 4.7% of variance with clinical factors explaining 21.6%.

CR- (Hypo)manic Episodes. Eight factors explained 40.6% (Nagelkerke's $R^2 = .406$, $X^2(9) = 46.876$, $p < .001$) of variance in number of (hypo)manic episodes at baseline. Increased time since first episode, education, more recent hypomania relevant experiences, higher adaptive coping, impulsivity, and dysfunctional attitudes were associated with more (hypo)manic episodes at baseline. More recent depression-relevant experiences and greater BAS activation were associated with fewer (hypo)manic episodes at baseline. Psychological factors contributed 13.8% of explained variance whereas the demographic and clinical factors contributed 26.8%.

Longitudinal results

Three factors explained 15.5% of the variance in the PR change score (Adjusted $R^2 = .155$, $F(3, 86) = 6.438$, $p = .001$). Being employed/meaningfully occupied, higher rumination

and lower PR at baseline predicted improved PR at follow-up. Rumination contributed 7% of explained variance, whereas, employment and baseline PR contributed 8.5%.

Sensitivity analyses for forward and backward selections, and for complete and imputed datasets yielded the same results.

Table 4. Results of final cross-sectional and follow-up models

	BRQ Total score				Cross-sectional (baseline) models Number of depressive episodes				Number of (hypo)manic episodes				Longitudinal (follow-up) model BRQ change score			
	β (SE)	CI	<i>t</i>	<i>p</i>	OR (SE)	CI	Wald χ^2	<i>P</i>	OR (SE)	CI	Wald χ^2	<i>p</i>	β (SE)	CI	<i>t</i>	<i>P</i>
Intercept/ threshold	2994.29 (139.57)	2717.35; 3271.29	21.45	<.001	DE_1= 14.98 (0.83)	2.95; 76.05 7.35;	10.67 18.18	001 <.001	HE_1= 502.88 (2.11)	8.12; 31146.17	8.73	.003	121.61 (206.96)	- 289.81; 533.02	0.59	.558
					DE_2=40. 14 (0.87)	219.17			HE_2= 1424.1 4 (2.14)	21.47; 94456.30	11.51	.001				
Demographic and clinical factors																
Gender					-			-	-			-	-			-
Women	199.36 (64.70)	70.92; 327.83	3.08	.003												
Time since first episode*	n/a			n/a	1.07 (0.02)	1.03; 1.10	11.08	.001	1.09 (0.02)	1.04; 1.13	15.99	< .001	n/a			n/a
<u>Highest education</u>	-			-	-			-				.006	-			-
Further									13.30 (0.85)	2.52; 70.10	9.31	.037				
Higher									4.88 (0.76)	1.10; 21.69	4.33	.002				
Employe nt status	-			-	-			-	-			-	155.45 (67.76)	20.75; 290.15	2.29	.024
Employed																
Relationshi p status	-186.54 (59.69)	-304.97; -68.10	-3.13	.002	-			-	-			-	-			-
Single																
CES-D	-15.25 (3.01)	-21.36; - 9.15	-4.96	< .001	1.04 (0.02)	1.00; 1.08	4.25	.039	-			-	-			-
HIQ-E	-			-	-			-	1.25 (0.07)	1.09; 1.42	10.60	.001	-			-

Table 4. Results of final cross-sectional and follow-up models

	BRQ Total score				Cross-sectional (baseline) models Number of depressive episodes				Number of (hypo)manic episodes				Longitudinal (follow-up) model BRQ change score			
	β (SE)	CI	<i>t</i>	<i>p</i>	OR (SE)	CI	Wald χ^2	<i>P</i>	OR (SE)	CI	Wald χ^2	<i>p</i>	β (SE)	CI	<i>t</i>	<i>P</i>
IDQ-E	-			-	-			-	0.82 (0.08)	0.70, 0.96	6.40	.011	-			-
BRQ BL	n/a			n/a	n/a			n/a	n/a			n/a	-0.17 (0.07)	-0.32; -0.03	- 2.34	.022
Psychological factors																
RSQ-R	-			-	-			-	-			-	6.86 (2.40)	2.09; 11.64	2.86	.005
RSQ-AC	12.66 (3.36)	6.00; 19.32	3.77	<.001	-			-	1.08 (0.03)	1.02; 1.13	7.03	.008	-			-
RSQ-RT	27.73 (11.80)	4.32; 51.15	2.35	.021	-			-	-			-	-			-
DAS-24	-3.80 (1.36)	-6.50; -1.11	-4.96	.006	-			-	1.02 (0.10)	1.01; 1.04	6.89	.009	-			-
BAS-T	-			-	-			-	0.89 (0.04)	0.83; 0.96	9.82	.002	-			-
IMPT-T	-			-	-			-	1.06 (.02)	1.01; 1.11	5.95	.015	-			-
IDQ-D	-14.50 (5.10)	-24.62; -4.38	-2.84	.005	1.075 (0.032)	1.01; 1.15	5.11	.024	-			-	-			-
Adjusted R ² / Pseudo R-Square		.557				.263					.406			.155		

Note: n/a: variable not included in the analysis, '-': variable dropped out of the model; β : unstandardized beta; SE: Standard error; CI: Confidence Intervals; *t*: t-test statistics; OR: Odds Ratio, Wald χ^2 : Wald test results, *p*: significance level; DE_1: depressive episodes factor first category (0-7); DE_2: Depressive episodes factors second category (8-19); HE_1: (Hypo)manic episodes factor- first category (1-7); HE_2: (Hypo)manic episodes factor- second category (8-19)

*Time since first episode was calculated by subtracting the age of onset from the current age. PR models included age of onset and age instead of time since first episode
BD diagnosis (BD-I, II, NOS) was not included in the main effect models; a comprehensive table of saturated main effects is provided in Supplementary materials, Table S.3.

Discussion

This study addressed gaps in the literature highlighted by previous research in PR in BD- using a prospective design and considering the impact of psychological factors, i.e. response styles for the first time (Dodd et al., 2017).

Cross-sectional findings

Psychological factors in PR. Higher negative self-dispositional appraisals and dysfunctional attitudes were associated with lower PR at baseline, and greater risk taking and adaptive coping were associated with better PR, while adjusting for clinical and demographic factors. The roles of depressive symptoms, gender, and relationship status in PR were consistent with previous literature (Dodd et al., 2017; Tse et al., 2014a).

Cognitive Vulnerability Model and PR. The associations between higher negative self-dispositional appraisals and dysfunctional attitudes and lower PR are not surprising. While the cross-sectional results cannot identify causality, a potential explanation could be based on previous research findings indicating that dysfunctional attitudes may predispose individuals with BD to be more severe course of illness (Lam et al., 2010). These attitudes focus on the need to strive for unrealistic goals such as constant positive affect, complete control over feelings, being able to solve problems easily, and achieve highly to be appreciated by others (Lam et al., 2004). Failure in these goals has been linked to self-criticism, hopelessness and depression, which in turn may impact negatively on PR.

Similarly, negative self-dispositional appraisals may exacerbate depression relevant experiences leading to spiralling negative thoughts (Jones and Day, 2008), which may lead to worse PR experiences. In contrast with Dodd et al. (2017), we found that negative self-dispositional appraisals remained a significant factor in PR at baseline after controlling for current mood. Our study used stepwise modelling with a more comprehensive list of

variables adjusted, which may explain this discrepancy, but further research is required for clarification.

Response Style Theory and PR. The supportive role of adaptive coping in PR is consistent with the literature, more specifically with the staging models of recovery in mental health problems, where the final stage includes factors such as actively managing mental health problems and living beyond disability (Leamy et al., 2011).

The association between improved PR and higher levels of risk taking at baseline was unexpected. Risk taking incorporates maladaptive, but potentially enjoyable activities such as recreational drug use, excessive alcohol consumption, engaging in casual sexual relationships, and reckless driving (Knowles et al., 2005). Our participants had low risk taking scores similar to those reported for euthymic individuals with BD and in general population samples (Thomas et al., 2007; Van der Gucht et al., 2009). We adjusted for depressive symptoms and negative self-appraisals, which showed positive associations with risk taking (see S.1. supplementary materials). It may be that low level risk-taking activities that are not associated with high levels of symptoms and negative self-appraisals, can be positive experiences and linked to better PR by experimenting and socialising more and initiating new relationships. In line with this, Tse and colleagues found that lifetime binge drinking was associated with more advanced stages of PR (Tse et al., 2014b).

Rumination showed bivariate association with PR (see Table S.2), but did not remain significant in the multivariate cross-sectional analysis.

BAS Dysregulation Model and PR. The present study did not identify any cross-sectional associations between BAS relevant psychological factors and PR.

Psychological factors in CR. Number of depressive and (hypo)manic episodes were examined in separate models at baseline. Higher negative self-dispositional appraisals were

associated with more depressive episodes at baseline. Dysfunctional attitudes, adaptive coping, and impulsivity were positively associated, while BAS processes were negatively associated with (hypo)manic episodes at baseline. Number of depressive and (hypo)manic episodes were largely independent of demographic characteristics, although higher education was associated with more (hypo)manic episodes. In line with the literature describing chronic presentation of BD and the potential for subsyndromal symptoms to increase bipolar relapse risk (Judd et al., 2008), we found that time since first episode and current mood were linked to worse clinical outcomes (both poles) at baseline.

Cognitive Vulnerability Model and CR. While the cross-sectional design cannot identify causality between the examined psychological factors and CR, a potential explanation for the association between negative self-dispositional appraisals and depression could be that higher rates of negative self-dispositional appraisals may be linked to spiralling negative thoughts about self, which, in turn, may intensify depressed mood and result in depressed episodes (Jones and Day, 2008). Similarly, higher rates of dysfunctional attitudes related to achievement and goal attainment may result in engagement in extreme pleasurable and goal oriented activities, such as extreme spending, overworking and irregularities in daily routine (Lam et al., 2004), which may lead to elevated mood and (hypo)manic episodes; in line with our results- identified association between dysfunctional attitudes and increased number of (hypo)manic episodes. However, it is also possible that the higher number of episodes increased the level of maladaptive thinking styles.

Response Style Theory and CR. Higher adaptive coping was associated with more (hypo)manic episodes at baseline, in line with prior evidence of associations between adaptive coping and (hypo)manic traits in the general population and with (hypo)manic episodes in BD (Thomas and Bentall, 2002; Thomas et al., 2007). This is consistent with the depression avoidance hypothesis of BD (Thomas and Bentall, 2002), suggesting distraction

as a response to depressive mood to avoid depressive episodes which may lead to overstimulation and circadian system disruption leading to (hypo)manic episodes (Thomas et al., 2007). However, adaptive coping does not solely incorporate distraction, it also includes help seeking and other active problem solving behaviour. Therefore, the results are not fully expected and future research would benefit from exploring distraction and other adaptive coping strategies separately. We did not identify other cross-sectional associations between response styles and CR in the multivariate analysis.

BAS Dysregulation Model and CR. In the cross-sectional multivariate analysis, higher rates of impulsivity were associated with more (hypo)manic episodes, consistent with research emphasizing the role of impulsivity in the development of (hypo)manic episodes (Swann et al., 2009). More surprisingly, higher rates of self-reported BAS was associated with fewer (hypo)manic episodes in the same model. The present study only examined cross-sectional associations between psychological factors and clinical outcomes. However, prospectively, both impulsivity and BAS processes have been found to predict time to onset of (hypo)manic episodes or symptom intensification (Alloy et al., 2008; Alloy et al., 2009b; Kwan et al., 2020; Meyer et al., 2001a; Swann et al., 2009).

Due to the cross-sectional design used to model clinical outcomes, it cannot be distinguished whether the examined psychological factors predict the course of BD or are the consequence of mood episodes. It is possible that past manic episodes downregulate self-reported BAS. In line with this, higher dampening was found to predict onset of manic and depressive symptomatology longitudinally (Gilbert et al., 2013). Moreover, antipsychotic medications (not controlled for in the present study) are frequently prescribed after manic episodes may dampen reward responsiveness (Abler et al., 2008; Johnson et al., 2012). Therefore, prospective studies adjusting for the impact of medication are required to clarify

the counter-intuitive association found here between BAS and the number of hypomanic episodes.

Finally, it is of note that adaptive coping, impulsivity and BAS did not show bivariate associations with the number of hypomanic episodes in the present study (see S.2-Supplementary materials). However, once examined together and adjusted for other factors in the multivariate analysis, including dysfunctional attitudes and recent experiences of hypomania (both associated with the number of (hypo)manic episodes, BAS and impulsivity), their significant association was identified. These psychological factors are rarely examined in one model and they overlap to some extent. However, it is possible that after adjusting for the negative impact of dysfunctional attitudes, recent hypomanic symptoms and impulsivity, additional fun seeking, drive and reward responsiveness could actually be linked to less acute (hypo)manic episodes. Future prospective research would benefit from exploring interplay between the examined psychological and clinical factors in predicting the number of (hypo)manic episodes. No associations were identified between BAS relevant psychological factors and the number of depressive episodes.

Comparison of psychological factors associated with CR and PR. CR and PR outcomes showed different cross-sectional associations with psychological factors, with the exception of dysfunctional attitudes, negative self-dispositional appraisals and adaptive coping strategies, indicating that processes proposed by the Cognitive Vulnerability Model and Response Style Theory may underpin both PR and CR. In contrast, BAS relevant psychological factors seem to underpin CR ([hypo]mania related) only.

Dysfunctional attitudes and negative self-dispositional appraisals were associated (and remained significant factors in the regression models) with lower PR and more (hypo)manic and depressive episodes at baseline, respectively. The former result highlights

the importance of realistic and achievable goals, as opposed extreme striving behaviour that is linked to (hypo)manic episodes and diminished PR. The latter finding indicates that interpretation of depression-relevant experiences may play an important role in depressive relapses, as well as in PR.

Higher adaptive coping was associated with higher PR as well as more (hypo)manic episodes at baseline, highlighting a tension between PR and CR that requires further exploration. It is possible that balanced level of distraction or engagement in relaxing activities may be an effective coping strategy with depressive symptoms, whilst more extreme distraction attempts may be associated with circadian rhythm and mood disturbances.

Only higher negative self-dispositional appraisals was associated with higher number of depressive episodes at baseline, indicating that psychological factors may play a more important role in PR and (hypo)manic episodes. The otherwise different trajectories to these outcomes, is in line with previous literature (Andresen et al., 2010).

Longitudinal study

Being in employment/meaningfully occupied and having higher rumination at baseline predicted improved PR at follow-up. This is consistent with cross-sectional evidence for positive associations between employment, having a meaningful role and PR (Dodd et al., 2017; Tse et al., 2014b). Our results show that being employed or having a meaningful occupational role predicts PR prospectively. Participants had higher employment rates compared to some previous studies (75% vs. 40-60%; Marwaha et al., 2013), perhaps due to participants not being solely recruited from hospitals and mental health clinics.

Prospective psychological factors in PR. In contrast with the cross-sectional results, higher rumination at baseline predicted improved PR at 6 months, but no other psychological

factors remained significant in the follow-up model. It is possible that concurrent psychological factors are important in PR, but these factors may not influence PR longitudinally.

Cognitive Vulnerability Model and change in PR. No prospective associations have been identified between psychological factors proposed by the Cognitive Vulnerability Model and change in PR.

Response Style Theory and change in PR. It is of note that rumination was not significant in the cross-sectional model, although there was a significant negative bivariate association with PR at baseline (see S.2- Supplementary document). It is possible that the current level of depression associated with both PR and rumination was a more important factor in PR at baseline. However, at follow-up, we did not collect clinical or psychological measures and we do not know if rumination and depression reduced over time.

This provides a potential explanation for the result concerning the prospective predictive role of rumination. Despite efforts to recruit individuals in euthymia, depressive symptoms were above clinical threshold (Radloff, 1977). Subsyndromal depressive symptoms are very common in BD impacting on similar research studies (Judd et al., 2003). Associations between rumination and depressive symptoms have been extensively identified (see Table 1) in line with our findings (see S.1- Supplementary materials). It is possible participants' depressive symptoms may have improved at 6 months, resulting in both reducing rumination and improving PR. Consistent with this Pavlickova et al. found that levels of rumination fluctuated over time and emotional states influenced subsequent levels of rumination (2013).

Moreover, research into the Nolen-Hoeksema rumination scale, identified 3 factors: depression-related rumination, brooding/self-blame, and reflection/introspection (Roberts et

al., 1998; Treynor et al., 2003). Rumination and brooding (directing one's attention to one's negative emotional state) have been linked with depression whereas reflection is considered more adaptive and can alleviate depression (Treynor et al., 2003). In a post-hoc analysis we divided rumination items into the subscales.² After controlling for baseline PR and employment status, only depression related rumination remained a significant predictor of improved PR at follow-up in the stepwise (backward) regression model. This supports our suggestion that higher depression and related rumination could have improved in 6 months explaining improvement in PR.

BAS Dysregulation Model and change in PR. No prospective associations have been identified between BAS relevant psychological factors and change in PR.

Strengths and limitations

This study is the first to systematically and prospectively review the psychological factors underpinning PR in BD; and compare baseline psychological factors in PR and in CR within the same bipolar population. We did not restrict recruitment to specific UK areas or to mental health services, to improve generalisability. High follow-up rates were achieved (84% vs 64-77% for similar periods; Baborik et al., 2013; Conus et al., 2006), reflecting service users' engagement and interest.

Study limitations include: psychological and clinical factors were not measured at follow-up, similarly to other studies (Dempsey et al., 2017); therefore, it is unknown whether they changed over time. Changes in psychological factors may be important in predicting subsequent PR, as outlined for rumination, which should be addressed in future research. 51% of participants came from a panel of research individuals, so could have been more

² Items could not be perfectly matched due to the modification of the Response Style Questionnaire since Treynor et al (2003). We only used matched items for exploration purposes, therefore, future research is required to confirm our results.

motivated. Despite efforts to recruit individuals in euthymia, depressive symptoms were high, consistent with most research in this field. Discrepancy between self-reported and observer-rated euthymia is well documented and the 16-point cut-off score for CES-D may be oversensitive, and a cut-off score of 20 has been instead recommended (Vilagut et al., 2016). Nevertheless, to control for this potential effect, depressive symptoms were adjusted for in the analysis.

Furthermore, stepwise regression models were used, which have weaknesses (i.e. selection statistic) and may have impacted on the outcomes. The rationale for using this approach was to avoid over-fitting and to provide a parsimonious ‘best fitting model’ for future research. Moreover, previous research in PR in BD did not provide sufficient theoretical justification for a hierarchical model.

Theoretical implications

Cross-sectional, findings were consistent with theoretical frameworks that emphasise that individuals’ mood experiences and interpretation/responses to these may underpin clinical outcomes in BD. In addition, the present study found that some of these psychological factors may also underpin concurrent PR outcomes. More specifically, psychological factors proposed by the cognitive vulnerability model, i.e. dysfunctional attitudes and maladaptive self-referential thinking, seem to be important in both CR and PR. In contrast, psychological factors proposed by the response style theory seem to play a more important role in PR (all the proposed factors underpinned PR) compared to CR (only adaptive coping was linked to the number of (hypo)manic episodes). BAS processes and impulsivity, linked to BAS theory, seemed to be important in the number of (hypo)manic episodes only, and did not show links to PR or depressive episodes. These findings are

potentially important for refining psychological models of PR in BD and for further development of clinical approaches designed to enhance PR.

Moreover, these findings also contribute to the literature considering the recovery paradigm in mental health problems. If different processes underpin CR and PR different trajectories of improvement are expected, which highlight a qualitative difference between the two recovery outcomes (Andresen et al., 2010; Macpherson et al., 2016). We found some overlap, but important differences too in the underpinning psychological factors. This is in line with the results of a recent review, proposing partial overlap between the two concepts (Leonhardt et al., 2017).

In line with the identified need to research mechanisms underpinning components of PR (van Weeghel et al., 2019), we focused on psychological underpinnings of PR in BD and our results to some extent corroborate the components of the CHIME model (Leamy et al., 2011). For instance self-referential thinking style seems to play an important role in PR in BD, which is in line with the identity component of the framework. Reducing negative self-referential thinking processes may facilitate rebuilding/redefining positive sense of identity. Moreover, using adaptive coping strategies may support improvement in most components of the CHIME framework, i.e. connectedness may be facilitated by being around people and asking help, and hope may be enabled by distraction from negative thoughts and using positive affirmations.

The results also extend the CHIME model (Leamy et al., 2011) by identifying additional psychological factors underpinning PR in BD. Ways in which individuals respond to low mood and deal with maladaptive and dysfunctional thinking processes as well as risk taking seem to play important roles in PR in BD. The CHIME framework has been criticised for not being sensitive to population characteristics and for omitting PR themes relevant to

coping with difficulties and courage/risk taking (for review see van Weeghel et al., 2019).

The present study provides preliminary empirical evidence that being able to cope with low mood, including both cognitive and behavioural strategies, and with dysfunctional attitudes relevant to achievement, goal attainment and dependency, as well as taking risks in controlled and positive ways may be important in PR in BD.

Clinical implications

Future developments of recovery-focused interventions may benefit from enhancing balanced adaptive coping strategies and engagement in pleasurable activities while targeting maladaptive psychological factors, such as dysfunctional attitudes of achievement, goal attainment, dependency, depression related rumination and negative self-dispositional appraisals. Cognitive behavioural therapies have an evidence base regarding fostering adaptive problem solving processes, and challenging maladaptive cognitive vulnerability, and are recommended by the NICE guideline for BD (NICE, 2014). However, the differences in underpinning factors for PR and CR highlight the importance of a more individualised and PR focused CBT approach.

Future research directions

This study focused on psychological factors linked to the most extensively researched psychological models of BD. Future prospective research may benefit from investigating (a) other psychological factors in PR in BD that were not investigated in the present study, but have been proposed by more complex integrated models, i.e. conflicting appraisals of internal states (Mansell et al., 2007); (b) response style components in isolation, i.e. distraction vs problem solving or brooding vs reflection; (c) whether changes in and interplay between clinical and psychological factors are associated with changes in PR outcomes and explore the pattern of these potential associations; (d) hypomania and mania separately, as some of

the psychological factors may be present in one but not in the other, which could explain some of the unexpected results. Moreover, future clinical trials should assess whether refined recovery-focused interventions, specifically targeting the identified psychological factors, are effective in facilitating better recovery experiences in individuals with BD.

Conclusion

Psychological factors played important roles in both CR and PR. The present study found that balanced adaptive coping and risk-taking response styles impact positively on concurrent PR experiences, while dysfunctional attitudes and negative self-dispositional appraisals had a negative association with concurrent PR. Prospective findings were less conclusive, potentially due to not examining changes in the psychological factors. However, higher baseline rumination predicted improvement in recovery at 6-month follow-up. The patterns of factors in PR and CR showed great variance, indicating that there is a difference between the two types of outcome measures supporting the service users' claims that clinical measures do not assess important aspects of recovery (Andresen et al., 2010).

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