Appraisals to Affect: Testing the Integrative Cognitive Model of Bipolar Disorder.

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Running title: Testing the Integrative Cognitive Model of Bipolar Disorder.

Objective: Cognitive models have suggested that extreme appraisals of affective states and maladaptive affect regulation strategies are important in the development of bipolar symptomatology. Little is known about the pathway by which these appraisals and behaviours interact in the formation of activated and depressed affective states. This study tested the predictions that i) ascent behaviours mediate the relationship between positive appraisals of activated mood and activation, and ii) descent behaviours mediate the relationship between negative appraisals of activated mood and depression.

Method: A total of 52 individuals, with a DSM-IV diagnosis of bipolar I or II disorder (confirmed by structured interview) completed biweekly assessments of affect regulation behaviours and mood for four weeks. Positive and negative appraisals of affective states were assessed at baseline through the Hypomanic Attitudes and Positive Prediction Inventory. Multilevel mediation analysis was used to explore the data.

Results: Ascent behaviours partially mediated the relationship between positive appraisals of activated mood and activation. Descent behaviours, but not negative appraisals of activated mood, predicted levels of depression indicating the absence of a mediation effect.

Conclusion: The results suggest that positive appraisals of activated mood can escalate activation in individuals with bipolar disorder. Such appraisals may be inherently rewarding and reinforcing directly elevating levels of activation, whilst increasing individuals' use of ascent behaviours. The results are consistent with the view that appraisals and behaviours should be targeted during cognitive behavioural therapy for bipolar disorder.

Key words: Bipolar disorder, affect regulation, activation, depression, appraisal.

Practitioner points

- It may be beneficial to target positive appraisals of activated mood in cognitive behavioural therapy for mania.

- Cognitive behavioural therapists may also wish to focus on identifying and targeting individuals' use of ascent behaviours in order to reduce highly activated states.

Limitations

- This study was cross-sectional in that it examined the relationship between variables at multiple concurrent time-points. Therefore, causality could not be established.

- The current research focused on positive and negative appraisals of activated internal states. It may be useful for future studies to explore appraisals of depressed internal states.

The impact of psychological intervention for bipolar disorder, such as cognitive behavioral therapy (CBT), remain significant but modest (e.g. Richardson, 2010). Advances in therapy will depend on an improved understanding of the factors responsible for the development and maintenance of manic and depressive symptoms. Two key areas of research have focused on affect regulation strategies and extreme appraisals of internal states, respectively. Affect regulation strategies refer to the behaviours and mental processes that people engage in to try to control their mood, such as dwelling on the consequences of affective states, or distracting themselves with risky activities. There is good evidence that these behaviours are elevated in people diagnosed with bipolar disorder (Gruber, Eidelman & Harvey, 2008; Gruber, Harvey & Gross, 2012) and are related to bipolar symptoms (Gruber, Eidelman, Johnson, Smith, & Harvey, 2011). In a separate body of work, extreme appraisals of internal states can influence the ways that people interpret their experiences of shifts in moods (e.g. happiness) and physiology (e.g. energised). These can be either extremely positive (e.g. "I can achieve anything") or negative (e.g. "I will make a fool of myself"). There is good evidence that these appraisals are elevated in bipolar disorder (Alatiq, Crane, Williams & Goodwin, 2010; Mansell, 2006; Mansell & Jones, 2006; Mansell,Paszek, Seal, Pedley, Jones, Thomas et al., 2011) and predict symptoms over time (Dodd, Mansell, Morrison & Tai, 2011a). However, there is little research on the potential association between behavioural strategies, appraisals, and internal states.

The integrative cognitive model of bipolar disorder and mood swings (Mansell et al., 2007) proposes that extreme beliefs about internal states drive the behavioural strategies that, in turn, maintain and escalate symptoms. The shift in internal state that is appraised could occur through either an external change in the environment (e.g. death of a loved one) or through an internal process that is part of the vicious cycle of the model (e.g. the effects of behaviours). Mansell et al. (2007) termed the behavioural strategies ascent and descent

behaviours (Mansell et al., 2007). Ascent behaviours are overt actions or internal mental acts that maintain or increase levels of activation (e.g. seeking social stimulation, mentally rehearsing positive outcomes), whereas descent behaviours are overt or internal mental actions that maintain or decrease activation (e.g. criticising the self, social withdrawal). This goal-relevant appraisal then drives behaviours to try to either suppress or enhance the affective state. Positive appraisals of highly activated states (e.g. "When I am full of energy I can achieve anything") entail the use of ascent behaviours, increasing activation. Negative appraisals of high activation states (e.g. "When I am agitated I make a fool of myself") entail the use of descent behaviours. These processes are regarded as important in the maintenance of mood swings, regardless of the nature and presence of a psychiatric diagnosis, yet they are proposed to be particularly pervasive and extreme in people with a diagnosis of bipolar disorder. Furthermore, the model describes a spiralling effect whereby subtle changes in internal state are amplified by the cycle, and 'normal' changes in internal state become 'abnormal', with the dividing line between the two being necessarily subjective.

Past research has found that ascent behaviours are associated with increased activation and mania risk in student samples (Dodd et al, 2011b; Fisk, Dodd & Collins, 2015). While extreme appraisals were associated with bipolar risk, activation and depression, the interaction between appraisals and behaviours was not significantly associated with these outcomes (Fisk, Dodd & Collins, 2015). To date, no studies have examined whether appraisals of internal states dictate levels of activation and depression through affect regulation behaviours (Mansell et al, 2007).

In the current study, it was predicted that ascent behaviours would mediate the relationship between positive appraisals of activated mood and activated states. The second hypothesis was that descent behaviours mediate the relationship between negative appraisals of activated and depressive states. Therefore, the aim was to investigate whether positive and

negative beliefs about internal states influence individuals' use of affect regulation strategies, which in turn exacerbate bipolar symptomatology.

Method

Sample

Participants were recruited through National Health Services (NHS), advertisements in voluntary sector publications, and University of Manchester Clinical Psychology participant pools. All participants met the criteria for a Diagnostics and Statistical Manual (Fourth Edition, text revision; American Psychiatric Association, 2000) diagnosis of bipolar I or II disorder. This was confirmed through telephone and face-to-face interviews at baseline using the Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders (SCID-I; First, Spitzer, Gibbon & Williams, 2002). The SCID-I also allowed data on number of previous episodes and months since last episode to be determined. Independent ratings of 10 audio recorded SCID-I interviews by the second and last authors demonstrated 100% interrater agreement. The study exclusion criteria were a diagnosis of primary substance abuse, schizophrenia, or schizoaffective disorder, and currently experiencing an episode of mania or major depression.

Measures

Demographic Questionnaire.

A sheet enclosed with the consent form asked about demographic information. This included age, gender, hours of CBT, use of psychiatric medication.

Hypomanic Attitudes & Positive Predictions Inventory (HAPPI; Mansell, 2006).

Items on the HAPPI reflect positive and negative appraisals of activated states, including the extent to which increased activation helps to avoid failure and loss of control,

regain autonomy, overcome fears, increase social standing, and promote idea generation and creativity. Participants were required to rate the extent to which they believed different statements to be true on a scale of zero (I don't believe this at all) to 100 (I believe this completely). All participants completed the HAPPI at baseline only.

Previous research has employed subscales from the HAPPI based on positive and negative appraisals of activated mood (Kelly et al., 2011). Thirteen items reflecting positive appraisals of activated mood were used in the current analyses (e.g. 'when I feel excited, my fears and worries are no longer real', 'when I feel excited I know that other people desire me'; $\alpha = 0.91$), whereas seven items reflected negative appraisals of activated mood (e.g. 'when I get excited about something I have no control over my thoughts', 'the better I feel about myself, the worse other people react towards me'; $\alpha = 0.83$). A full listing of the items used is presented by Kelly and colleagues (2011).

Internal States Scale (ISS; Bauer et al, 1991)

The ISS requires participants to rate the degree to which they have experienced internal states associated with bipolar disorder over the past 24 hours on a scale of zero (not at all/rarely) to 100 (very much so/much of the time). Two subscales of the ISS were selected for the purposes of the current analysis. These were: activation (five items e.g. 'I feel overactive'; $\alpha = 0.90$ in t1 data) and depression (two items e.g. 'It seems that nothing will ever work out for me'; $\alpha = 0.73$ in t1 data). The ISS is significantly associated with observer-rated symptom measures (Bauer et al, 1991; Bauer et al, 2000). In this study, the total score for each subscale was entered into the analysis.

Behaviour checklist (BC; Fisk, Dodd & Collins, 2015).

This 21-item measure assesses normalising behaviours (e.g. 'had regular breaks to unwind'), ascent behaviours (e.g. 'hyped myself up as much as possible', 'done everything faster') and descent behaviours (e.g. 'been hard on myself', 'withdrawn from other people'). Fisk, Dodd & Collins (2015) found the behaviour checklist to have adequate convergent and divergent validity with existing measures of response style relevant to bipolar disorder (i.e. the Responses to Positive Affect Scale (Feldman et al, 2008) and Response Styles Questionnaire (as adapted by Knowles et al, 2005)) in a non-clinical student sample.

For the purpose of the current analysis only the ascent (seven items; $\alpha = 0.81$ in t1 data) and descent (seven items; $\alpha = 0.77$ in t1 data) behaviour scales were used. These scales measure both overt goal directed behaviours and attempts to control internal mental processes, such as thoughts and emotions. Participants were asked to rate their engagement with each behaviour on a Likert scale from one = not at all to four = nearly all of the time. The ascent and descent behaviour subscales were not significantly correlated in the baseline data ($Rho = -.14$, $p=.346$).

Procedure.

Further details of the assessments within this study are provided in a previous publication (Dodd et al, 2011a). Other assessments were employed by Dodd and colleagues (2011a), but they are not included in the current article. This study was approved by a National Health Service Research Ethics Committee. Initially all participants provided written informed consent and completed the SCID-I and demographic questionnaire. Two booklets were sent via post to those who had given informed consent; booklet 1 contained all baseline assessments (e.g. the HAPPI) and booklet 2 was a self-assessment diary that

contained all follow-up measures (e.g. the ISS and the BC) to be completed bi-weekly for four consecutive weeks. Pre-paid envelopes were provided to return these. Participants were asked to return booklet 1 as soon as it had been completed. Participants returned the diary separately once they had completed all 4 weeks of assessments. They were asked to write the date and time on each diary entry. Participants had the opportunity to complete the ISS and BC a maximum of eight times over the course of the study.

Statistical analysis

All analyses were conducted in Stata 12.0 (Stata Corporation, 2012). Initially, the authors explored whether age, gender, months since last depressive episode, months since last manic episode, medication (yes/no), and hours of cognitive behavioural therapy predicted activation and depression levels. Those variables found to significantly predict either outcome were included as covariates in the later mediation analysis.

Multilevel mediation analysis was conducted using the 'ml_mediation' command, which accounts for the non-independent observations in this data as the different time-points are nested within individuals, and that the independent variable does not vary within participants, where participant number (the highest level of nesting) was included as the random effect (Krull & MacKinnon, 2001; Rogers, 1993). Mediation was said to occur if i) the independent variable predicted the dependent variable; ii) the independent variable significantly predicted the mediating variable; and iii) the strength of the relationship between the independent and dependent variables weakened or disappeared when the mediating variable was included as an additional predictor (MacKinnon, 2008). The effect of the independent variable on the dependent variable in the third model is termed the direct effect, and the effect of the independent variable on mediating variable in Model Two multiplied by

the effect of the mediating variable on dependent variable in Model Three gives the indirect effect. The direct and indirect effects sum to give the total effect. Consistent with this approach, three models were tested in order to explore whether ascent behaviours mediated the relationship between positive appraisals of activated mood and activation. In Model One, the authors tested whether positive appraisals of activated mood predicted activation. In Model Two, the authors tested whether positive appraisals of activated mood predicted greater use of ascent behaviours. In Model Three, the authors tested whether the strength of the relationship between positive appraisals and activation diminished or disappeared when use of ascent behaviours was included as an additional independent variable.

Following this, three further models were tested to explore whether descent behaviours mediated the relationship between negative appraisals of activated mood and depression. In Model Four, the authors tested whether negative appraisals of activated mood predicted depression levels. In Model Five, the authors tested whether negative appraisals of activated mood predicted greater use of descent behaviours. In Model Six, the authors tested whether the strength of the relationship between negative appraisals and depression levels diminished when descent behaviours were included in the model. The data was manually standardised to aid the interpretation of the results. In this dataset all dependent variables showed a negative skew violating the assumption of normally distributed data. Therefore, bootstrapping with 1000 repetitions was employed in order to estimate the standard error and 95% confidence intervals. Bootstrapping has been recommended when parametric assumptions are not met (Mooney & Duval, 1993).

Results

Of the seventy-eight individuals who consented to take part in the study, 68 met diagnostic criteria for bipolar I or II disorder. Sixteen participants failed to provide analysable

data (i.e. ISS scores at t1 or months since last manic episode) and were therefore excluded from the current analyses. The final sample comprised of 52 individuals (male, n = 12) with a mean age of 48.4. 44 participants met the criteria for bipolar I disorder. 50 participants completed the assessments at all eight time-points. The summary statistics for key variables are displayed in Table 1.

[Please insert Table 1 around here]

Assessment of covariates

As can be seen in Table 2, regression analysis showed that all of the covariates predicted either activated or depressed mood. They were therefore included as covariates in the mediation analysis.

[Please insert Table 2 around here]

Mediation analysis

The results of the multilevel mediation analysis are summarised in Figure 1. In Model One, positive appraisals of activated mood strongly and significantly predicted activation (β = .37, p <.001, bootstrapped SE: 0.03, 95% CI: 0.32 - 0.43). In Model Two, positive appraisals of activated mood also significantly predicted use of ascent behaviours (β = .29, p <.001, bootstrapped SE: 0.04, CI: 0.20 - 0.38). Lastly, in Model Three, the strength of the relationship between positive appraisals of activated mood and activation reduced, but remained statistically significant, in the presence of the ascent behaviours (β = .28, p <.001, bootstrapped SE: 0.04, CI: 0.21 - 0.35). Ascent behaviours significantly predicted activation

indicating a partial mediation effect (β = .31, p <.001, bootstrapped SE: 0.05, CI: 0.20 - 0.42). The estimates for the direct, indirect and total effects for these models are presented in Table 3. The proportion of the effect mediated was 0.24, with a ratio of direct to indirect effect of 0.31.

In Model Four, negative appraisals of activated mood did not significantly predict levels of depression (β = .06, p = 0.182, bootstrapped SE: 0.04; CI: -0.03 - 0.14). In Model Five, negative appraisals of activated mood weakly, but significantly, predicted use of descent behaviours (Model Five; β = .10, p = .032, bootstrapped SE: 0.05, CI: 0.01 - 0.19). In Model Six, descent behaviours (β = .38, p < .001, bootstrapped SE: 0.05, CI: 0.28 - 0.48), but not negative beliefs about activated mood (β = .02, p = .606, bootstrapped SE: 0.04, CI: -0.06 - 0.10), significantly predicted depression. Therefore, negative appraisals of activated mood did not seem to be related to levels of depression and no mediation effect was observed (Figure 2).

[Please insert Figure 1, Figure 2 and Table 3 around here]

Discussion

This study tested the hypothesis that ascent behaviours mediate the relationship between positive appraisals of activated mood and activation in individuals with bipolar disorder, consistent with the integrative cognitive model of mood swings (Mansell et al., 2007). It also examined whether descent behaviours mediate the relationship between negative appraisals of activated mood and depression.

In regards to hypothesis one, the data showed a partial mediation effect suggesting that positive appraisals of activated mood partly influence resultant internal state by

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generating unhelpful affect regulation behaviours. However, the data also showed a stronger direct effect of appraisals on activation, suggesting that the majority of this effect does not occur through behaviours, but rather an alternative pathway. Therefore, this study supports a link between appraisals of internal state (e.g. Mansell et al., 2007), on the one hand, and affect regulation behaviours (e.g. Mansell et al. 2007; Gruber et al., 2011), on the other, in their connection with activation. The findings are consistent with Mansell and colleague's (2007) model in which the positive appraisals of activated states drive ascent behaviours which in turn escalate the activated state. Nevertheless, it is important to note that the direct effect was larger than the indirect effect, suggesting that positive beliefs exert the majority of their influence on activation directly, rather than by influencing behaviour. It is possible that extreme positive appraisals, thoughts and cognitions are in themselves inherently rewarding and reinforcing, and serve to further escalate activated states. Previous research has suggested that cognitive/internal affect regulation strategies such as self- and emotion-focused rumination about positive affect are associated with high mood (e.g. Feldman, Joormann & Johnson, 2008; Gruber et al, 2011). It is also possible that ascent behaviours are relatively idiosyncratic and not necessarily captured in the behaviour checklist, which may have attenuated the mediation effect. For example, illicit drug taking (e.g. stimulants) is not represented in this measure. However, the behaviour checklist includes items measuring internal mental behaviours, in addition to overt goal-focused behavioural strategies, which is consistent with Mansell and colleagues' (2007) model.

Our second hypothesis was not supported in that negative appraisals of activated mood were not related to depression level, and only weakly predicted descent behaviours. Nonetheless, descent behaviours did significantly predict depressed mood, which is consistent with their potential role as a maintenance process in the Mansell and colleague's (2007) model. The reasons for the weak effects of negative appraisals on behaviours and

depression are unclear, especially as they appear to be valuable in discriminating individuals with bipolar disorder from non-clinical and unipolar depressed individuals (Kelly et al., 2011). Notably, within the simple prospective analysis of this data, 'loss of control' appraisals at baseline, but not 'social self-criticism' appraisals were associated with depression levels at one month (Dodd et al., 2011c). It is possible that certain negative appraisals of activated mood take more than a month to affect depression. Alternatively, they might be less stable because they surface in the presence of certain social situations in which the high moods are problematic (e.g. rejection from significant others). Another possibility is that depression is largely related to transdiagnostic appraisals that were not assessed in this study, such as unconditional beliefs around worthlessness and social exclusion. This study is consistent with the view that appraisals of activated states, and behaviours carried out in response to these states, need to be targeted in therapy (e.g. Searson, Mansell, Lowens, & Tai, 2012). This study provides a tentative suggestion that the effect of appraisals on activated states may be better explained in this way than the effects on depression. It may be helpful to address descent behaviours, as well as a wider array of psychosocial factors (e.g. perceived criticism, social exclusion, helplessness), that are typically implicated in depression.

This study was cross-sectional in that it examined associations between variables at multiple concurrent time-points. Therefore, causality could not be established. It is possible that greater levels of activation and depression are responsible for fostering more extreme appraisals of affect. Indeed, there is a wider methodological challenge in testing cognitive models that involve a 'vicious cycle', with linear or cross-sectional statistics. The study was also limited by relatively modest statistical power. A major advantage of this study was that participants provided multiple ratings of their mood and behaviours. This may have allowed for a more valid and sensitive measure to be taken across different situations and times of the day (Palmier-Claus et al., 2011). The current research focused on positive and negative

appraisals of activated emotional states. It may be useful for future studies to explore appraisals of depressed mood states as these may better predictor descent behaviours and depression. The BC, while novel, has strong convergent and incremental validity when compared with existing measures of affect regulation known to be associated with bipolar disorder (Fisk, Dodd & Collins, 2015). The BC had small reliability alphas in the student sample; however, internal consistency was improved in the present study among individuals with diagnosed bipolar disorder. There were no clinical or non-clinical control groups in the study so the specificity of the effects to bipolar disorder and its transdiagnostic relevance (as specified by Mansell et al., 2007) could not be confirmed. Additionally, the ISS depression scale was comprised of two items limiting its construct validity. In the future the findings will require replication using other validated assessments of mania and depression. Lastly, surprisingly, the number of hours of CBT was a significant and positive predictor of depression. It is possible that this represents a trend whereby those clients with greater levels of depression were more likely to receive psychological intervention.

To conclude, we aimed to test the role of behavioural responses in mediating the influence of extreme appraisals on bipolar symptoms. We found evidence of partial mediation of behaviours in the case of the effects of positive appraisals on manic symptoms, and a direct effect of descent behaviours on depressed mood. These findings are consistent with the Mansell et al. (2007) model. However, they may indicate subtly different processes at work depending on the effects on mood state that are being explained. In this way, the study throws further light on directions for clinical intervention and future research.

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Table 1. Summary statistics for key variables averaged across all time-points.

	Mean	SD	Min	Max
ISS activation	114.5	124.4	0	500.0
ISS depression	45.3	55.2	0	200.0
Ascent behaviours	11.0	4.0	7.0	27.0
Descent behaviours	11.9	3.9	7.0	27.0
HAPPI positive appraisals	51.8	22.7	3.1	97.7
HAPPI negative appraisals	41.6	21.4	1.4	91.4

Key: ISS: Internal State Scale, HAPPI: Hypomanic Attitudes & Positive Predictions Inventory; SD: Standard deviation.

Table 2. Multilevel regression analysis - predictors of activation and depression.

DV	IV	Bootstrapped β	SE	p	95% CI Lower	Upper
Activation	Months since last mania	-0.23	0.03	<0.001	-0.28	-0.17
	Months since last depression	-0.19	0.02	<0.001	-0.23	-0.15
	Age	0.06	0.03	0.037	0.00	0.12
	Gender	0.10	0.03	0.001	0.04	0.17
	Hours of CBT	0.10	0.05	0.071	-0.01	0.21
	Medication (yes/no)	0.05	0.02	0.036	0.00	0.09
Depression	Months since last mania	-0.02	0.05	0.733	-0.11	0.08
	Months since last depression	-0.19	0.04	<0.001	-0.27	-0.10
	Age	-0.03	0.04	0.507	-0.10	0.05
	Gender	0.07	0.04	0.114	-0.02	0.15
	Hours of CBT	0.17	0.05	0.001	0.07	0.27
	Medication (yes/no)	0.02	0.03	0.554	-0.04	0.08

Key: DV - dependent variable, IV - independent variable, SE - standard error; CI -confidence interval.

Table 3. The indirect, direct and total effects.

	Estimate	SE	p	95% CI Lower	Upper
Indirect effect of positive beliefs on activation	0.09	0.02	<0.001	0.04	0.13
Direct effect of positive beliefs on activation	0.28	0.04	<0.001	0.21	0.35
Total effect (direct + indirect)	0.37	0.03	<0.001	0.31	0.43
Indirect effect of negative beliefs on depression	0.04	0.02	0.034	0.00	0.07
Direct effect of negative beliefs on depression	0.02	0.04	0.606	-0.06	0.10
Total effect (direct + indirect)	0.06	0.04	0.175	-0.03	0.14

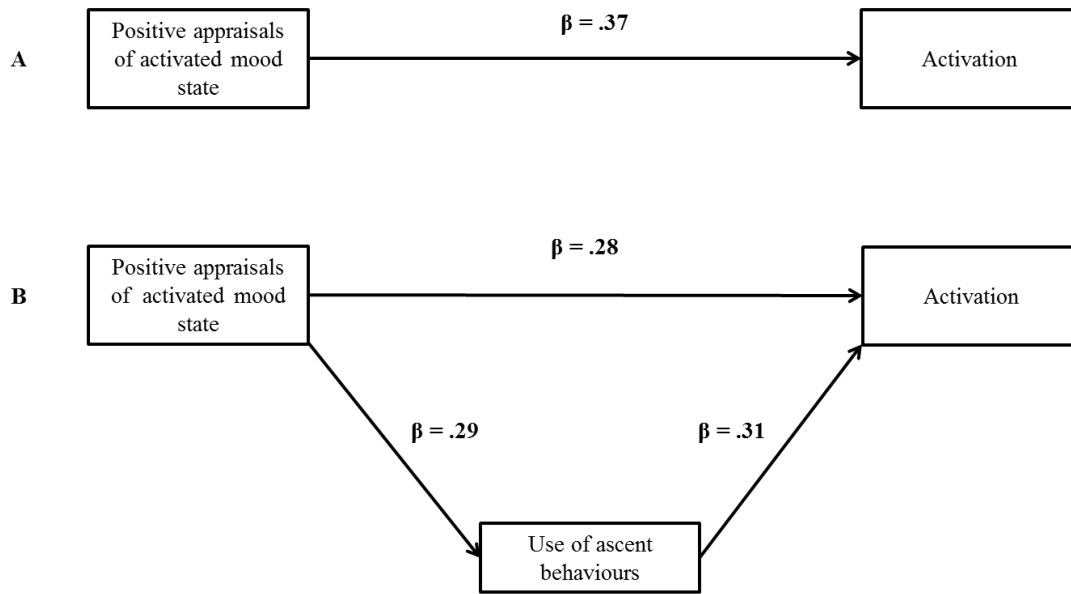Key: SE - standard error, CI - confidence interval.

Figure 1. A) shows the effect of positive appraisals of activated mood on levels of activation. B) shows the β coefficients when positive appraisals of activated moods and ascent behaviours were entered into the same model as predictors of activation. B) also shows the β coefficient when positive appraisals of activated mood was entered as a predictor of ascent behaviours.
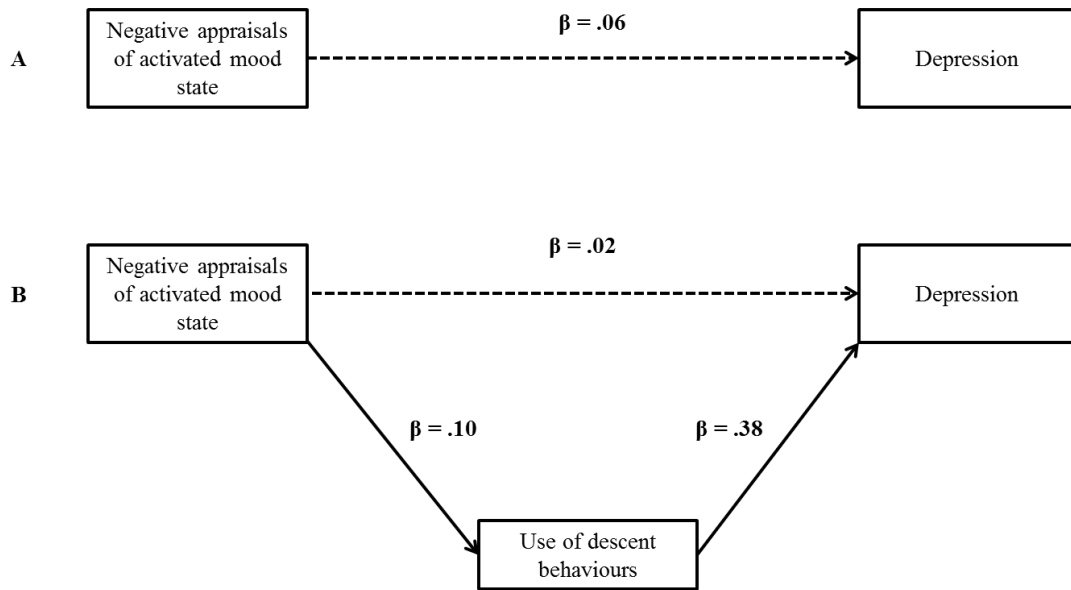
Figure 2. A) shows the effect of negative appraisals of activated mood states on levels of depression. B) shows the β coefficients when negative appraisals of activated mood and descent behaviours were entered into the same model as predictors of depression. B) also shows the β coefficient when negative appraisals of activated mood was entered as a predictor of descent behaviours.