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Family Influences on Mania-Relevant Cognitions and Beliefs: A Cognitive Model of Mania and Reward

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Abstract

Objective—The present study proposed and tested a cognitive model of mania and reward.

Method—Undergraduates ($N = 284$; 68.4% female; mean age = 20.99 years, standard deviation ± 3.37) completed measures of family goal setting and achievement values, personal reward-related beliefs, cognitive symptoms of mania, and risk for mania.

Results—Correlational analyses and structural equation modeling supported two distinct, but related facets of mania-relevant cognition: stably present reward-related beliefs and state-dependent cognitive symptoms in response to success and positive emotion. Results also indicated that family emphasis on achievement and highly ambitious extrinsic goals were associated with these mania-relevant cognitions. Finally, controlling for other factors, cognitive symptoms in response to success and positive emotion were uniquely associated with lifetime propensity towards mania symptoms.

Conclusions—Results support the merit of distinguishing between facets of mania-relevant cognition and the importance of the family in shaping both aspects of cognition.

Keywords

mania; cognitions; family socialization

Symptoms of mania often emerge in the context of reward (Johnson, 2005; Johnson et al., 2008; Johnson et al., 2000), yet the precise mechanisms guiding this symptomatic response remain largely unknown. The present study examines these associations by proposing and testing a cognitive model of mania and reward. Within this model, we posit that cognitive symptoms of mania include overly positive cognitive responses to success or positive emotions and that these cognitive symptoms are associated with elevated risk for mania. We further propose that these cognitive symptoms are driven by the activation of reward-related beliefs regarding the importance and attainability of reward, which are socialized in part within the family context. Whereas cognitive symptoms fluctuate dynamically with context, reward-related beliefs appear to be stably present. The present study first reviews the theoretical and empirical foundations of this model. We then provide a preliminary test of this model by examining relations between family environment, reward-related beliefs, cognitive symptoms of mania, and mania risk in an undergraduate sample.

Conceptual Model: Mania in a Cognitive Framework

Cognitive theories suggest that cognitive, affective, and behavioral symptoms of psychopathology result when maladaptive attitudes and beliefs are activated by relevant external life events (Beck, Rush, Shaw, & Emery, 1979). While this model has been applied most frequently to unipolar depression, Mansell and colleagues have also proposed cognitive models of bipolar disorder that integrate both manic and depressive symptoms (Mansell, Morrison, Reid, Lowens, & Tai, 2007). The cognitive model presented in the present study, in contrast, focuses exclusively on mania.

Reward-related symptoms of mania

Previous research has documented associations of mania with heightened sensitivity of the behavioral approach system (BAS; Depue & Iacano, 1989), a biobehavioral system involved in the facilitation of goal-directed behavior. Specifically, BAS sensitivity has been found to be elevated among those diagnosed with the disorder, and has been found to predict the onset, course, and severity of mania (Alloy et al., 2009; Johnson et al., in press).

Within Beck's cognitive model of depression, affective, behavioral, and cognitive symptoms are intertwined and reciprocally connected (Beck et al., 1979). Based on a review of the existing empirical findings, we propose that symptoms of mania can also be fit to this tripartite model. Specifically, after a rewarding event or emotion, individuals with a history or vulnerability to mania have been found to exhibit (a) affective symptoms (elevations in excitement and energy), (b) behavioral symptoms (increased goal-striving), and (c) cognitive symptoms (positive overgeneralizations and self-focused positive rumination). Together, the affective, behavioral, and cognitive symptoms comprise many of the core symptoms of a manic episode. We review the evidence for each of these three components in the following sections.

Affective symptoms

Elevations in mood, one of the key symptoms associated with mania, may be triggered by experiences of reward (Meyer, Johnson, & Winters, 2001). For example, compared with healthy controls, individuals diagnosed with bipolar I disorder reported experiencing more positive emotions when presented with the prospect of reward, as measured using the self-reported behavioral activation scale (Meyer et al., 2001) as well as psychophysiological measures of responsivity to reward (Harmon-Jones et al., 2008; Sutton & Johnson, 2002). These elevations have been well-replicated even during periods of remission (see Johnson et al., 2011 for a review). Moreover, recent evidence suggests that reward responsivity can predict the onset of disorder (Alloy et al., 2009) and a more severe course of symptoms over time (Alloy et al., 2012).

Behavioral symptoms

Increases in goal-directed behavior have long been identified as a key symptom of a manic episode. Recent empirical work has also demonstrated that among individuals at risk for mania or with a history of manic symptoms, increases in goal striving can be triggered by an initial rewarding experience. Compared with healthy controls, people diagnosed with bipolar I disorder showed greater effort after attaining better-than-expected progress toward a goal (Fulford, Johnson, Llabre, & Carver, 2010). Similarly, after an initial success, students with a higher vulnerability to mania chose a more difficult task than those students without similar vulnerabilities (Johnson, Ruggero, & Carver, 2005). Given cues of incentive, people diagnosed with bipolar I disorder have been found to expend more effort towards earning a reward (Hayden et al., 2008) and to show more sustained engagement as a task becomes progressively more difficult (Harmon-Jones et al., 2008). These findings suggest that

persons at risk for and those diagnosed with bipolar disorder experience increased goal pursuit or striving after a triggering success.

Cognitive symptoms

Among individuals prone to mania, two types of maladaptive cognitive processes seem to emerge in response to success or positive emotions. First, findings from several studies suggest that a history of hypomanic symptoms was positively associated with higher expectancies for future success after an initial success (Eisner, Johnson, & Carver, 2008; Johnson et al., 2005; Stern & Berrenberg, 1979). This process has been labeled as positive over-generalization. A second type of maladaptive cognitive process, positive rumination, has been shown to emerge in response to positive emotion. Specifically, individuals at-risk for mania and with a diagnosis of bipolar disorder have both been shown to respond to positive emotions with self-focused positive ruminations focused on personal achievements and goals (Feldman, Joormann, & Johnson, 2008; Johnson, McKenzie, & McMurrich, 2008).

In the present study, we conceptualize positive overgeneralization and positive rumination as cognitive symptoms of mania that arise in response to success or positive emotions. Previous research suggests that these patterns of cognition are associated with increased risk for mania. For example, previous research has shown that hypomanic states are characterized by increased confidence (Jones, Mansell, & Waller, 2006; Meyer, Beevers, & Johnson, 2004) and imagery of achieving goals (Gregory, Brewin, Mansell, & Donaldson, 2010). Importantly, this sense of overconfidence has also been shown to predict a worse course of manic symptoms over time (Lam, Wright, & Sham, 2005).

Summary

Taken together, the existing research suggests that reactivity to reward and reward-relevant emotion plays a key role in behavioral, affective, and cognitive symptoms of mania. Specifically, for individuals prone to mania, increased behavioral striving for reward, elevations in mood, and overly confident cognition can be triggered by rewarding events and positive emotions. Thus, it is important to understand the more stable cognitive factors that may set the stage for this reactivity.

Reward-related beliefs

Cognitive models posit that certain events trigger symptoms because they match and activate an individual's maladaptive beliefs and attitudes regarding the self, the world, or others (Beck et al., 1979). Negative beliefs relevant to unipolar depression typically involve negative views of self worth or efficacy; as such, events that affirm or match these beliefs are then theorized to trigger the onset of depressive symptoms. Conversely, beliefs relevant to mania may involve reward-relevant beliefs regarding the attainment and relevance of reward (Lam, Wright, & Smith, 2004). Events that match these beliefs, e.g., experiences of success or positive emotions, may thus contribute to the onset of manic symptoms detailed above.

Several types of beliefs about goals and achievement have been found to be relevant to bipolar disorder. Work by Dodd and colleagues (Dodd, Mansell, Morrison & Tai, 2011a; Dodd, Mansell, Morrison, & Tai, 2011b) indicates that beliefs regarding activated states, for example, the belief that it is necessary to be active to avoid failure, predicted manic symptoms over time. Likewise, Lam et al. (2004) suggest that bipolar disorder is characterized by dysfunctional beliefs of goal attainment, such as an emphasis on extreme striving, and the conviction that one can "excel at anything if one tries hard enough" (p. 198). Finally, people diagnosed with and those at elevated risk for bipolar disorders have

been found to endorse extremely ambitious life goals (cf. Johnson & Carver, 2006; Johnson, Eisner, & Carver, 2009), even when controlling for mood state. In particular, people prone to mania seem oriented towards the pursuit of highly ambitious, extrinsically oriented goals (e.g., popular fame, financial success), rather than other-oriented or intrinsic rewards (e.g., close family relationships).

Similar to the focus on setting high goals, individuals with bipolar disorder also endorse beliefs that *achievement* is central to self-worth (Lam et al., 2004), and that achievement is necessary to be acknowledged by others. As with beliefs of goal-attainment, these beliefs of achievement appear to be present among individuals at risk or with a history of bipolar disorder, even in the absence of problematic mood states (Lomax & Lam, 2010; Wright, Lam, & Newsom Davis, 2005).

Taken together, two types of reward-related beliefs appear to be stably present among those prone to mania: an emphasis on goal attainment and a belief that achievement is central to self-worth.

Family influences

Cognitive models propose that maladaptive beliefs are formed through early experiences, particularly within the family environment (Beck et al., 1979). While no empirical work has explored social mechanisms influencing the formation of mania-relevant beliefs and cognitions, a number of theories suggest that the family environment is instrumental in contributing to children's views of achievement and reward. In particular, applications of attribution theory (Kelly & Michela, 1980; Miller, 1995) indicate that parents attribute their children's achievements to either effort or innate ability (Stevenson et al., 1990). These beliefs are then adopted by children and used as attributions for their own achievements. Applied to the present model, it is possible that the mania-relevant beliefs of achievement and goal attainment may be influenced by a family emphasis on achievement and ambitious goal setting. These beliefs may be particularly influenced by parental endorsement of extrinsic rather than intrinsic goals.

In addition to influencing reward-related beliefs, family goal setting, particularly in extrinsic domains, may also influence the cognitive responses to success and positive emotion that have been implicated in mania risk. A wide body of literature indicates that parents serve as socializing agents in children's goal setting (Duriez, Soenens, & Vansteenkiste, 2007; Vansteenkiste, Lens, & Deci, 2006). For example, findings from the social cognitive literature indicate that children's own academic goal setting is influenced by the academic goals set for them by their parents (Zimmerman, Bandura, & Martinez-Pons, 1992). Applied to the present model, it is possible that a familial emphasis on ambitious goals and achievement may shape an individual's cognitive responses to success and positive emotions, specifically by interpreting rewarding events as a prelude to even greater success (i.e., upward generalizations) or focusing on the attainment of goals (i.e., self-focused positive rumination).

Summary of the conceptual model

Our synthesis of the existing research leads to the development of an integrative cognitive model of mania and reward (Figure 1). In this model, family environment is expected to contribute to the formation of beliefs about reward and responses to success. As reviewed, two types of beliefs about reward have been shown to be stably present among persons prone to mania: an over-emphasis on goal attainment and a belief that self-worth depends on achievement. The existence of these beliefs sets the stage for cognitive symptoms of mania, namely, overly confident cognitive responses to success and positive emotion. These

cognitive symptoms, in turn, reciprocally influence other mania-relevant symptoms, namely, affective symptoms (e.g., elevations in excitement, energy, and mood) and behavioral symptoms (e.g., increased goal pursuit), thus contributing to increased risk for a manic episode.

Two indirect or mediated pathways are suggested by this conceptual model. First, as noted, cognitive models suggest that early events shape the development of psychopathology through the formation of maladaptive beliefs. Applied to the present model, it is possible that factors in the family environment do not directly influence cognitive symptoms of mania; rather, their effects are mediated by reward-relevant beliefs. Second, the existing research suggests that reward-relevant beliefs are stably present cognitions that persist regardless of mood state and set the stage for cognitive symptoms of mania. Therefore, it is possible that the associations of reward-relevant beliefs with mania risk are mediated through cognitive symptoms of mania.

Testing the Conceptual Model

We have described two key cognitive variables relevant to mania: reward-related beliefs and cognitive symptoms that arise in response to success or positive emotion. Little is known, though, regarding the potential origins of these two cognitive variables.

Despite the disadvantages associated with analogue samples, we chose to test this model in a student population with no history of family or individual mental illness. A history of mental illness may confound cognitions regarding reward, in that the impairments and economic costs associated with bipolar disorder likely shape attitudes towards goal attainment and success. Thus, testing this model within an analogue sample provides insight into cognitive mechanisms that appear to be present before the onset of manic episodes.

As illustrated in Figure 1, we test five hypotheses within this sample:

1. Family socialization (i.e., a family emphasis on achievement and ambitious extrinsic goals) will be associated with reward-related beliefs.
2. Reward-related beliefs will be associated with cognitive symptoms of mania, defined as overly positive cognitive responses to success and positive emotions.
3. Reward-related beliefs will mediate relations between family environment and these cognitive symptoms of mania.
4. Cognitive symptoms of mania will mediate relations of reward-related beliefs and mania risk.
5. Controlling for other factors, cognitive symptoms of mania will be uniquely associated with increased mania risk.

Method

Participants

Participants were 284 (68.4% female) students at the University of California, Berkeley who enrolled in the experiment for course credit. Participants signing up for research participation were provided with a link to an online survey. Participants were excluded from analysis if they reported that they or their parents were previously diagnosed with or treated for depression, bipolar disorder, or other affective disorders ($n = 56$).

Of the 228 participants included in the main analysis, 48.7% of participants identified as Asian American, 19.3% as White, 6.6% as Chicano/Latino, and 0.9% as African American.

Additionally, 4.8% of the final sample identified as biracial and 16.2% identified as international (i.e., non-American) students. Participants ranged in age from 18.05–56.98 years old (mean [M] = 20.99, standard deviation [SD] $\pm$ 3.37). Participants reported on their family's estimated annual income and their parents' years of education. Mean family income for this sample was \$66,405 ($SD \pm$ \$30,496). Mean years of education were 14.19 years ($SD \pm$ 4.71) for mothers (i.e., some college education) and 15.21 years for fathers ($SD \pm$ 4.81).

Measures

Family socioeconomic status—Paternal and maternal education levels were positively related ($r = .74$, $p < .0001$) and were both positively related to estimated family income (r s for parental and maternal education = .28 and .31, respectively, p s $< .0001$). To reduce the number of total covariates in the main analyses, a continuous composite variable for family socioeconomic status (SES) was created by first standardizing, then averaging paternal education, maternal education, and family income.

Mania risk—Lifetime propensity towards mania was assessed using the Hypomanic Personality Scale (HPS; Eckblad & Chapman, 1986). The HPS is a 48-item self-report scale designed to measure risk for bipolar disorder. Many of the items capture tendencies toward manic symptoms, including episodic shifts in positive affect, extraversion, energy, and goal-driven behavior (e.g., “I often feel excited and happy for no apparent reason,” “I frequently find my thoughts are racing”). Other items capture personality traits believed to be related to mania risk, such as impulsivity and extraversion. Responses range from 1 (*very true*) to 4 (*very false*). High scores on the HPS have been associated with DSM-IV diagnoses of bipolar disorder (e.g., Eckblad & Chapman, 1986), current symptoms of mania (Klein, Lewinsohn, & Seeley, 1996), and increased risk for the development of manic episodes and related symptoms over a 10-year period (Kwapil et al., 2000). Alpha reliability for the HPS in the present sample was .88 (48 items).

Family socialization—Two measures were used to assess the socialization of achievement in the family context.

Family goal setting—An adapted version of the Willingly Approached Set of Statistically Unlikely Pursuits (WASSUP; Johnson & Carver, 2006) was used to measure parents' ambitious goal setting. The WASSUP is a 30-item questionnaire with seven subscales reflecting unique types of aspirations. For the present study, participants indicated the likelihood to which parents/caregivers in their families would set particular goals for them, from 1 (no chance a parent/caregiver would set this goal for me) to 5 (at least one parent/caregiver in my family would definitely set this goal for me). Subscales tapped goals of popular fame (e.g., someone will write a book about your life; $\alpha = .89$, nine items), idealized relations with friends (e.g., everyone you know will love you; $\alpha = .85$, five items), having an impact on world well-being (e.g., you will stop world hunger; $\alpha = .84$, two items), political influence (e.g., you will be president of your country; $\alpha = .72$, two items), idealized relations with family (e.g., your children will see you as the perfect parent; $\alpha = .84$, five items), money/financial success (e.g., you will run a Fortune 500 company; $\alpha = .77$, 4 items), and creative output (e.g., you will create a great work of art, music, or poetry; $\alpha = .67$, six items).

Family emphasis on achievement—The Family Environment Scale (FES; Moos & Moos, 1986) comprises 90 true/false items scored on 10 subscales. The present study used the Achievement subscale from the FES (e.g., getting ahead in life is very important in our family). Alpha reliability for the FES-Achievement was .57 (nine items) in the present sample. The low reliability in this sample was slightly improved (.59) with the omission of

one item (“In our family, we don’t try that hard to do better,” reverse-scored); however, given the minimal increase in reliability, this item was left in the scale.

Reward-related beliefs—The Dysfunctional Attitude Scale for Bipolar Disorder (DAS: BD; Lam et al., 2003) is comprised of 24 items with high scores corresponding to endorsement of dysfunctional attitudes. Two subscales from the DAS—goal attainment (e.g., “I ought to be able to solve problems quickly; A person should do well at everything”; $\alpha = .73$, six items) and achievement (e.g., “If I do not do well all the time, people will not respect me; People who have good ideas are more worthy...than those who do not”; $\alpha = .81$, five items)—were used for this study. Participants indicated their agreement with the beliefs expressed by the item statements using a 7-point scale, ranging from 1 (totally disagree) to 7 (totally agree).

Cognitive symptoms—Two measures were used to assess cognitive symptoms of mania.

Response to Positive Affect – Self-Focus Scale (RPA)—The RPA Scale (Feldman et al., 2008) was designed to capture cognitive responses to positive affect. The scale was modeled after the Ruminative Responses Scale (RRS; Nolen-Hoeksema & Morrow, 1991), which measures cognitive responses to negative affect. Respondents indicate on a Likert scale ranging from 1 (*almost never*) to 4 (*almost always*) the frequency with which they tend to respond in specific ways when feeling happy, excited, or enthused. The RPA comprises three factor-analytically derived subscales. The Self-focused subscale was used in the present study and includes four items that assess the tendency to respond to positive affective states with thoughts about positive aspects of one’s self and goals (e.g., “...think ‘I am achieving everything’” or “...think ‘I am living up to my potential’”). As only this scale focuses on tendencies to think about success and achievement, this was the only subscale used in this study. The scale has been found to correlate with measures of mania risk, such as the Hypomanic Personality Scale (Feldman et al., 2008; Gruber et al., 2008; Raes, Daems, Feldman, Johnson, & Van Gucht, 2010). Alpha reliability for the self-focused rumination scale was .76 (four items) in the present sample.

Positive generalization-upward generalization—The Positive Generalization Scale (POG; Eisner et al., 2008) was developed to capture overly confident responses to success. Items on the upward generalization subscale of the POG are designed to capture the tendency to generalize one success to more lofty goals in the same domain (five items, e.g., “If someone praises the way I express something, it makes me think I can write a popular book”). Each item presents a hypothetical success followed by a tendency to generalize that success to a loftier, more difficult success in the same domain. Respondents indicate on a Likert scale the degree to which they agree with each statement, ranging from 1 (*I disagree a lot*) to 4 (*I agree a lot*). The upward generalization scale of the POG was used in the present study and has been positively associated with mania risk (Eisner et al., 2008; Fulford, Johnson, & Carter, 2008; Johnson & Jones, 2009). Alpha reliability for the POG-upward generalization scale was .83 (six items) in the present sample.

Results

Descriptive Analyses

Variables were first screened for normality and outliers. No variables were found to have high skewness (absolute value > 2) or kurtosis (> 7) using the cutoffs suggested by West, Finch, and Curran (1995; Table 1). In addition, Cook’s distance was used to screen the data for outliers, and no outliers were found using the cutoff of one.

Correlational Analysis

Before conducting structural equation modeling, partial correlations were conducted between family factors (extreme goal setting and emphasis on achievement), participants' reward-relevant beliefs, cognitive symptoms of mania, and mania risk (HPS) scores while controlling for family SES, participant gender, and participant age (Table 2). Consistent with hypotheses, parental extreme goal setting in all domains was positively associated with both forms of cognitive symptoms (self-focused rumination and upward generalization) and with mania risk. In addition, family achievement emphasis was positively associated with both attainment and achievement beliefs. Partially consistent with our hypothesis, some, but not all domains of parent goal setting (popular fame, friends, family, and money) were positively associated with participants' beliefs regarding goal attainment and/or achievement. Family achievement emphasis was marginally associated with upward generalization, but unrelated to self-focused rumination.

Zero-order correlations between participants' cognitive symptoms of mania, reward-related beliefs, and mania risk were also examined (see Table 3). As expected, correlations between cognitive symptoms and reward-related beliefs were in the small to medium range ($r_s = .25-.41$), suggesting that these measures may be measuring related, but distinct factors.

Structural Equation Modeling

Structural equation modeling (SEM) was used to examine the factor structure of the hypothesized cognitive model of mania and as the primary test of the multivariate model shown in Figure 2. The MLR estimator of Mplus 5.2 (Muthen & Muthen, 2007) was used for SEM analyses.

Measurement model—Confirmatory factor analysis was conducted to examine support for the factor structure of the hypothesized cognitive model of mania (Figure 1). Based on the existing literature, we hypothesized two separable factors of mania-relevant cognitions: (a) a common factor of *reward-related beliefs* (indicated by participants' attitudes toward goal-attainment and achievement) and (b) a common factor of *cognitive symptoms of mania*, indicated by upward generalizations and self-focused rumination in response to reward and positive emotion. In addition, based on research distinguishing extrinsic and intrinsic goal setting in bipolar disorder (Carver & Johnson, 2006; Johnson, Carver & Gotlib, under review), we hypothesized that our measures of the family environment would load onto three distinguishable factors: extrinsic goal setting (i.e., political influence, popular fame, and world influence scales on the WASSUP), intrinsic goal setting (i.e., family relationships, friendships, and creativity scales on the WASSUP), and a general emphasis on achievement (FES-achievement).

Maximum likelihood estimation procedures were used to test the measurement portion of the model. For a relatively good fit with the data and hypothesized model, Hu and Bentler (1999) recommended cutoff criteria for comparative fit index (CFI) $\geq .95$, standardized root mean square residual (SRMR) $\leq .08$, and root mean square error of approximation (RMSEA) $\leq .06$. Based on these criteria, the theoretical model fit the data well, χ^2 ($N = 229$, degree of freedom [df] = 67) = 32.13; CFI = 1.00, RMSEA = .00, SRMR = .032. All scales loaded positively and significantly on their respective factors.

Structural model—As indicated in Tables 2 and 3, relations between predictor variables, hypothesized mediators, and outcome variables were supported by correlational analyses. Potential mediators (i.e., reward-related beliefs, cognitive symptoms) were tested simultaneously in the model. Multivariate delta methods (MacKinnon, Lockwood, Hoffman,

West, & Sheets, 2002; Sobel, 1986) were used to test the statistical significance of the indirect effects.

Figure 2 shows the results of the model. As indicated, participant gender, participant age, and family SES were included as covariates. Consistent with Hypothesis 1, family emphasis on achievement was positively and uniquely related to reward-related beliefs. Also consistent with Hypothesis 1, family extrinsic goal setting was positively related to cognitive symptoms of mania. Inconsistent with Hypothesis 1, family extrinsic goal setting was not uniquely related to reward-related beliefs above and beyond the effects of other variables. Consistent with Hypothesis 2, reward-related beliefs were positively and significantly related to cognitive symptoms.

Consistent with Hypothesis 3, reward-related beliefs mediated the effects of family achievement emphasis on cognitive symptoms ($z = 2.92, p < .01$). Cognitive symptoms were also hypothesized to mediate the effects of family extrinsic goal setting and reward-related beliefs on mania risk (Hypothesis 4), but these effects only approached significance ($z = 1.78$ and $1.69, ps < .10$, respectively).

Finally, consistent with Hypothesis 5, controlling for all other factors in the model, cognitive symptoms contributed uniquely to mania risk. Factors in the model accounted for 32.3% of the variance of mania risk.

Summary of Results

The present study proposed and tested a cognitive model of mania and reward. Consistent with cognitive models and theories of family socialization, our findings suggest that reward-related beliefs and cognitive symptoms of mania may be socialized in part by the family environment. Also consistent with cognitive models, examination of indirect effects in our model suggests that the effect of family influences on maladaptive cognitive responses to success and positive emotion may be mediated by reward-related beliefs. Finally, cognitive symptoms of mania were uniquely associated with elevated risk for mania, above and beyond other effects in the model.

Discussion

A growing literature has documented reward-related cognitions among people with a history of mania and those at risk for mania. These findings imply two distinct facets of reward-relevant cognition: stably present beliefs that extremely high goals must and can be attained, and specific cognitions that emerge in a state-dependent fashion in response to success and happiness. Though some evidence had suggested that cognitive constructs in mania are separable (Johnson & Jones, 2009; Mansell, Rigby, Tai, & Lowe, 2008), no previous research had examined family contributions to these two facets of cognition.

Findings from the present study indicate that reward-related beliefs and cognitive symptoms of mania are indeed distinguishable constructs, each with different relations to mania risk. As noted, previous research suggests that beliefs about the importance of attaining goals and investment in attaining extremely high goals are trait-like features that do not appear to shift with mood, whereas positive over-generalizations of success and a focus on one's own successes are state-dependent and may signal the prodromal phase of a manic or hypomanic episode (Carver & Johnson, 2009; Fulford et al., 2008; Gruber & Johnson, 2009; Johnson & Carver, 2006; Wright et al., 2005). The current findings supported these hypotheses, namely, reward-related beliefs were positively associated with cognitive symptoms of mania. In multivariate analyses, only cognitive symptoms of mania were uniquely and directly

associated with a lifetime propensity toward subsyndromal symptoms above and beyond effects of other variables in the model.

We also hypothesized that cognitive symptoms of mania would mediate the effects of these stably present beliefs on mania risk, but this indirect pathway was only marginally significant. Though mediation cannot be fully supported in cross-sectional designs (Cole & Maxwell, 2003), the current results provide preliminary support for the idea that reward-related beliefs set the stage for cognitive symptoms of mania such as overconfidence and positive rumination, whereas cognitive symptoms of mania may be an early warning sign of manic or hypomanic episodes.

While overall correlations between our key variables fell in the small to moderate range, our results provide some of the first evidence that the family environment plays an important role in shaping cognitions relevant to mania. Specifically, findings from the structural model indicated that a family emphasis on achievement shaped a person's views toward the importance or attainability of reward. A family emphasis on extrinsic, unattainable goals also shaped a person's cognitive responses to success or positive emotion. Both of these effects were moderately large. We also hypothesized that effects of the family environment on cognitive symptoms of mania would be mediated through the formation of reward-relevant beliefs. The absence of direct effects from family socialization variables to a broader measure of mania risk suggests that a family emphasis on achievement and ambitious goal setting does not contribute directly to mania risk; rather, these effects are contingent on the formation of maladaptive cognitions and beliefs.

In sum, the current study suggests the merit of distinguishing between stable and state-dependent facets of reward-relevant cognition and also supports the importance of the family in shaping both aspects of cognition. While our study was conducted with an analogue sample, these findings hold a number of implications for treatment and intervention with individuals at heightened risk for mania, as well as those with a diagnosis of bipolar disorder. For example, among individuals at risk for mania, the presence of reward-related cognitions may predict the onset of a broader spectrum of manic symptoms. Identifying and targeting these cognitions prior to an initial manic episode may be critical to preventing the development of bipolar disorder within this population. The associations between aspects of the family environment and mania-relevant cognitions and beliefs also suggest new potential targets for family-focused treatments of bipolar disorder. To-date, family-focused treatments have primarily targeted high expressed emotion as a risk factor for relapse (Miklowitz et al., 2000). Our findings suggest that other mechanisms in the family context—namely, a family emphasis on highly ambitious goals and achievement—may also contribute to poorer outcomes in the course of bipolar disorder and may do so through cognitive mechanisms.

Finally, the conceptual distinction between stably present beliefs and state-dependent cognitions may also inform the treatment of individuals with a history of manic episodes. Consistent with findings by Wright et al. (2005), our findings suggest that reward-related beliefs are likely to be accessible regardless of current mood state, and therefore may be targets of treatment even during euthymic periods. Treatments targeting contingent views of self-worth (e.g., Niiya, Crocker, & Bartmess, 2004) may be particularly relevant for challenging and modifying these beliefs (Crocker & Knight, 2005).

A number of limitations in the present study are important to acknowledge. First, the single-informant approach may be susceptible to bias, particularly with measures assessing family views on achievement and goal setting. For example, it is possible that those persons who were most invested in goals were biased toward over-reporting their family members'

emphasis on achievement and goals. Additionally, previous individual and family history of mental illness were both assessed via self-report, and so it is not clear whether findings will generalize to those with a personal or family history of bipolar diagnosis. Future investigations would benefit by also including reports from parents or other family members.

The cross-sectional design of the present study makes it impossible to confirm the directionality of relations between our key constructs. Other studies, however, have found that beliefs about the importance and attainability of high goals predict a worse course of mania (Alloy et al., 2009; Johnson et al., in press). For example, in longitudinal analyses, increases in manic symptoms over time have been predicted by self-reported emphasis on achieving goals (Alloy et al., 2009; Francis-Raniere, Alloy, & Abramson, 2006), as well as by highly ambitious goals for achieving fame and wealth (Johnson et al., in press). Finally, in contrast to other cognitive models of bipolar disorder (e.g., Mansell et al., 2007) the proposed model focuses solely on mania-relevant cognitions. Future research is needed to examine whether similar cognitive processes are also observed in depressive phases of bipolar disorder.

Beyond addressing methodological limitations, several future directions are suggested by these findings. As a cognitive profile of mania is increasingly well-established, it becomes important to understand how such a profile develops. One approach will likely involve disentangling genetic and biological contributions to cognitive features. These findings, though, suggest that even in a sample that is not characterized by family history of bipolar disorder, family environment can play a major role in shaping cognitive profiles. Further work is needed to understand how the social environment can set the stage for these risk variables in bipolar disorder.

References

- Alloy LB, Bender RE, Wagner CA, Abramson LY, Urosevic S. Longitudinal predictors of bipolar spectrum disorders: A Behavioral Approach System (BAS) perspective. *Clinical Psychology: Science and Practice*. 2009; 16:206–226. [PubMed: 20161008]
- Alloy LB, Urosevic S, Abramson LY, Jager-Hyman S, Nusslock R, Whitehouse WG, Hogan M. Progression along the bipolar spectrum: A longitudinal study of predictors of conversion from bipolar spectrum conditions to bipolar I and II disorders. *Journal of Abnormal Psychology*. 2012; 121(1):16–27. [PubMed: 21668080]
- Beck, AT.; Rush, AJ.; Shaw, BF.; Emery, G. *Cognitive therapy of depression*. New York, NY: Guilford Press; 1979.
- Carver CS, Johnson SL. Tendencies toward mania and tendencies toward depression have distinct motivational, affective, and cognitive correlates. *Cognitive Therapy Research*. 2009; 33:552–569. [PubMed: 20376291]
- Cole DA, Maxwell SE. Testing mediational models with longitudinal data. Questions and tips in the use of structural equation modeling. *Journal of Abnormal Psychology*. 2003; 112:558–577. [PubMed: 14674869]
- Coryell W, Endicott J, Keller M, Andreasen N, Grove W, Hirschfeld RMA, Scheftner W. Bipolar affective disorder and high achievement: A familial association. *American Journal of Psychiatry*. 1989; 146:983–988. [PubMed: 2750997]
- Crocker J, Knight KM. Contingencies of self-worth. *Current Directions in Psychological Science*. 2005; 14:200–203.
- Dodd AL, Mansell W, Morrison AP, Tai S. Factor structure of the Hypomanic Attitudes and Positive Predictions Inventory and associations with analogue bipolar symptoms in a student sample. *Personality and Individual Differences*. 2011a; 50:349–354.

- Dodd AL, Mansell W, Morrison AP, Tai S. Extreme appraisals of internal states and bipolar symptoms: The hypomanic attitudes and positive predictions inventory. *Psychological Assessment*. 2011b; 23:635–645. [PubMed: 21500923]
- Duriez B, Soenens B, Vansteenkiste M. In search of the antecedents of adolescent authoritarianism: the relative contribution of parental goal promotion and parenting style dimensions. *European Journal of Personality*. 2007; 21(4):507–527.
- Eckblad M, Chapman LJ. Development and validation of a scale for hypomanic personality. *Journal of Abnormal Psychology*. 1986; 95(3):214–222. [PubMed: 3745642]
- Eisner LR, Johnson SL, Carver CS. Cognitive responses to failure and success relate uniquely to bipolar depression versus mania. *Journal of Abnormal Psychology*. 2008; 117:154–163. [PubMed: 18266493]
- Feldman G, Joormann J, Johnson SL. A self-report measure of responses to positive affect: Rumination and Dampening. *Cognitive Therapy and Research*. 2008; 32:507–525. [PubMed: 20360998]
- Francis-Raniere EL, Alloy LB, Abramson LY. Depressive personality styles and bipolar spectrum disorders: prospective tests of the event congruency hypothesis. *Bipolar Disorders*. 2006; 8:382–399. [PubMed: 16879139]
- Fulford D, Johnson SL, Carver CS. Commonalities and differences in characteristics of persons at risk for narcissism and mania. *Journal of Research in Personality*. 2008; 42:1427–1438. [PubMed: 20376289]
- Fulford D, Johnson SL, Llabre MM, Carver CS. Pushing and coasting in dynamic goal pursuit: Coasting is attenuated in bipolar disorder. *Psychological Science*. 2010; 21:1021–1027. [PubMed: 20519486]
- Gregory JD, Brewin CR, Mansell W, Donaldson C. Intrusive memories and images in bipolar disorder. *Behavior Research and Therapy*. 2010; 48:698–703.
- Gruber J, Johnson SL. Positive emotional traits and ambitious goals among people at risk for mania: The need for specificity. *International Journal of Cognitive Therapy*. 2009; 2(2):179–190.
- Gruber J, Johnson SL, Oveis C, Keltner D. Risk for mania and positive emotional responding: Too much of a good thing? *Emotion*. 2008; 8(1):23–33. [PubMed: 18266513]
- Harmon-Jones E, Abramson LY, Nusslock R, Sigelman JD, Urosevic S, Turonie LD, Alloy LB, Fearn M. Effect of bipolar disorder on left frontal cortical responses to goals differing in valence and task difficulty. *Biological Psychiatry*. 2008; 63:693–698. [PubMed: 17919457]
- Hayden EP, Bodkins M, Brenner C, Shekhar A, Nurnberger JI, O'Donnell BF, Hetrick WP. A multi-method investigation of the behavioral activation system in bipolar disorder. *Journal of Abnormal Psychology*. 2008; 117:164–170. [PubMed: 18266494]
- Hu LT, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*. 1999; 6:1–55.
- Johnson SL. Life events in bipolar disorder: Towards more specific models. *Clinical Psychology Review*. 2005; 25:1008–1027. [PubMed: 16129530]
- Johnson S, Carver CS. Extreme goal setting and vulnerability to mania among undiagnosed young adults. *Cognitive Therapy and Research*. 2006; 30(3):377–395. [PubMed: 20198117]
- Johnson SL, Carver CS, Gotlib I. Elevated ambitions for fame among persons diagnosed with bipolar I disorder. *Journal of Abnormal Psychology*. (in press).
- Johnson SL, Cuellar AK, Ruggero C, Winnett-Perlman C, Goodnick P, White R, Miller I. Life events as predictors of mania and depression in Bipolar I disorder. *Journal of Abnormal Psychology*. 2008; 117:268–277. [PubMed: 18489203]
- Johnson SL, Edge MD, Holmes MK, Carver CS. The behavioral activation system and mania. *Annual Review of Clinical Psychology*. (in press).
- Johnson SL, Eisner LR, Carver CS. Elevated expectancies among persons diagnosed with bipolar disorder. *British Journal of Clinical Psychology*. 2009; 48:217–222. [PubMed: 19254445]
- Johnson SL, Jones S. Cognitive correlates of mania risk: are responses to success, positive moods, and manic symptoms distinct or overlapping? *Journal of Clinical Psychology*. 2009; 65:891–905. [PubMed: 19455611]

- Johnson SL, McKenzie GL, McMurrich S. Ruminative responses to negative and positive affect among students diagnosed with bipolar disorder and major depressive disorder. *Cognitive Therapy and Research*. 2008; 32(5):702–713. [PubMed: 20360996]
- Johnson SL, Ruggero CJ, Carver CS. Cognitive, behavioral, and affective responses to reward: Links with hypomanic symptoms. *Journal of Social and Clinical Psychology*. 2005; 24(6):894–906.
- Johnson SL, Sandrow D, Meyer B, Winters R, Miller I, Solomon D, Keitner G. Increases in manic symptoms after life events involving goal attainment. *Journal of Abnormal Psychology*. 2000; 109:721–727. [PubMed: 11195996]
- Jones S, Mansell W, Waller L. Appraisal of hypomania-relevant experiences: Development of a questionnaire to assess positive self-dispositional appraisals in bipolar and behavioural high risk samples. *Journal of Affective Disorders*. 2006; 93:19–28. [PubMed: 16503056]
- Kelly H, Michela J. Attribution theory and research. *Annual Review of Educational Psychology*. 1980; 78:373–380.
- Klein DN, Lewinsohn PM, Seeley JR. ; Hypomanic personality traits in a community sample of adolescents. *Journal of Affective Disorders*. 1996; 38:135–143. [PubMed: 8791182]
- Kwapil TR, Miller MB, Zinser MC, Chapman LJ, Chapman J, Eckblad M. A longitudinal study of high scorers on the hypomanic personality scale. *Journal of Abnormal Psychology*. 2000; 109:222–226. [PubMed: 10895560]
- Lam D, Wright K, Sham P. Sense of hyper-positive self and response to cognitive therapy in bipolar disorder. *Psychological Medicine*. 2005; 35(01):69–77. [PubMed: 15842030]
- Lam D, Wright K, Smith N. Dysfunctional assumptions in bipolar disorder. *Journal of Affective Disorders*. 2004; 79(1–3):193–199. [PubMed: 15023494]
- Lomax CL, Lam D. Investigation into activation of dysfunctional schemas in euthymic bipolar disorder following positive mood induction. *British Journal of Clinical Psychology*. 2010; 50:115–126. [PubMed: 21545446]
- MacKinnon DP, Lockwood CM, Hoffman JM, West SG, Sheets V. A comparison of methods to test mediated and other intervening variable effects. *Psychological Methods*. 2002; 7:83–104. [PubMed: 11928892]
- Mansell W, Morrison AP, Reid G, Lowens I, Tai S. The interpretation of, and responses to, changes in internal states: An integrative cognitive model of mood swings and bipolar disorders. *Behavioural and Cognitive Psychotherapy*. 2007; 35:515–539.
- Mansell W, Rigby Z, Tai S, Lowe C. Do current beliefs predict hypomanic symptoms beyond personality style? Factor analysis of the hypomanic attitudes and positive predictions inventory (HAPPI) and its association with hypomanic symptoms in a student population. *Journal of Clinical Psychology*. 2008; 64:450–465. [PubMed: 18327768]
- Meyer B, Beevers CG, Johnson SL. Goal appraisals and vulnerability to bipolar disorder: A personal projects analysis. *Cognitive Therapy and Research*. 2004; 28:173–182.
- Meyer B, Johnson S, Winters R. Responsiveness to threat and incentive in bipolar disorder: Relations of the BIS/BAS Scales with Symptoms. *Journal of Psychopathology and Behavioral Assessment*. 2001; 23(3):133–143. [PubMed: 21765592]
- Miklowitz D, Simoneau T, George E, Richards J, Kalbag A, Sachs-Ericsson N, Suddath R. Family focused treatment of bipolar disorder: 1-year-effects of a psychoeducational program in conjunction with pharmacotherapy. *Biological Psychiatry*. 2000; 48:582–592. [PubMed: 11018229]
- Miller S. Parents' attributions for their children's behavior. *Child Development*. 1995; 66:1557–1584. [PubMed: 8556886]
- Moos, RH.; Moos, BS. Family Environment Scale. Palo Alto, CA: Consulting Psychologists Press; 1986.
- Muthen, LK.; Muthen, BO. Mplus User's Guide. 5. Los Angeles, CA: Muthen & Muthen; 1998–2007.
- Niiya Y, Crocker J, Bartmess E. From vulnerability to resilience: Learning orientations buffer contingent self-esteem from failure. *Psychological Science*. 2004; 15:801–805. [PubMed: 15563324]

- Nolen-Hoeksema S, Morrow J. A prospective study of depression and posttraumatic stress symptoms after a natural disaster: The 1989 Loma Prieta earthquake. *Journal of Personality and Social Psychology*. 1991; 61:115–121. [PubMed: 1890582]
- Raes F, Daems K, Feldman GC, Johnson S, Van Gucht D. A psychometric evaluation of the Dutch version of the Responses to Positive Affect questionnaire. *Psychologica Belgica*. 2010; 49:293–310.
- Sobel, ME. Some new results on indirect effects and their standard errors in structure equation models. In: Leinhardt, S., editor. *Social methodology*. San Francisco, CA: Jossey Bass; 1986. p. 159-186.
- Stern GS, Berrenberg JL. Skill-set, success outcome, and mania as determinants of the illusion of control. *Journal of Research in Personality*. 1979; 13:206–220.
- Stevenson HW, Lee S, Chen C, Stigler JW, Hsu C, Kitamura S, Hatano G. Contexts of achievement: A study of American, Chinese, and Japanese Children. *Monographs of the Society for Research in Child Development*. 1990; 55(1/2):i–119.
- Sutton SK, Johnson SJ. Hypomanic tendencies predict lower startle magnitudes during pleasant pictures. *Psychophysiology*. 2002; 39:80. [PubMed: 12206298]
- Vansteenkiste M, Lens W, Deci EL. Intrinsic versus extrinsic goal contents in self-determination theory: Another look at the quality of academic motivation. *Educational Psychologist*. 2006; 41(1): 19–31.
- West, SG.; Finch, JF.; Curran, PJ. Structural equation models with non-normal variables: Problems and remedies. In: Hoyle, R., editor. *Structural equation modeling: Concepts, issues, and applications*. Thousand Oaks, CA: Sage; 1995. p. 56-75.
- Wright K, Lam D, Newsom-Davis I. Induced mood change and dysfunctional attitudes in remitted bipolar I affective disorder. *Journal of Abnormal Psychology*. 2005; 114(4):689–696. [PubMed: 16351389]
- Zimmerman BJ, Bandura A, Martinez-Pons M. Self-motivation for academic attainment: The role of self-efficacy beliefs and personal goal setting. *American Educational Research Journal*. 1992; 29:663–676.

Figure 1.
A cognitive model of mania and reward.

A COGNITIVE MODEL OF MANIA AND REWARD

Figure 2.

Model testing direct and indirect relations of the main variables.

Note. Standardized estimates are in parentheses. Solid lines indicate significant paths. Bold lines indicate significant indirect paths. Dotted lines indicate nonsignificant paths. * p < .05. ** p < .01. *** p < .000.

Table 1

Descriptive Data for Main Variables

	Mean (N)	SD	Skew	Kurtosis	α (items)
Hypomanic Personality Scale	109.27 (223)	17.05	-.25	-.24	.88 (48)
Family measures					
FES – Achievement	6.30 (225)	1.84	-.51	-.30	.57 (9)
WASSUP-Popular Fame	1.74 (225)	.76	1.43	2.50	.89 (9)
WASSUP-Friends	3.05 (225)	.93	-.08	-.73	.83 (5)
WASSUP-World Well-Being	2.02 (225)	1.03	.94	.31	.84 (2)
WASSUP-Family Relationships	3.44 (225)	.99	-.44	-.71	.84 (5)
WASSUP-Money	2.16 (225)	.90	.47	-.71	.77 (4)
WASSUP-Creativity	2.72 (225)	.73	.29	-.47	.67 (6)
WASSUP-Political Influence	1.78 (225)	.86	1.04	.46	.72 (2)
Achievement attitudes					
DAS-High Goal Attainment	4.86 (223)	.93	-.60	.91	.73 (6)
DAS-Achievement	4.21 (223)	1.31	-.39	-.18	.81 (5)
Cognitive responses to reward					
Upward generalization	14.44 (224)	3.60	-.14	-.55	.83 (6)
Self-focused rumination	2.51 (223)	.67	.16	-.50	.76 (4)

Note. SD = standard deviation. FES = Family Environment Scale, WASSUP = Willingly Approached Set of Statistically Unlikely Pursuits, DAS = Dysfunctional Attitude Scale

Table 2
Partial Correlations Between Family Achievement Attitudes, Cognitive Reward Responses, and Reward Attitudes

	Self-focused rumination	Upward generalization	Goal attainment attitudes	Achievement attitudes	Mania risk
Popular fame	.14 [*]	.41 ^{***}	.08	.18 ^{**}	.33 ^{***}
Friends	.25 ^{***}	.28 ^{***}	.17 [*]	.11	.29 ^{***}
World	.25 ^{***}	.36 ^{***}	.09	.06	.25 ^{***}
Politics	.22 ^{**}	.33 ^{***}	-.03	.09	.33 ^{***}
Family	.22 ^{**}	.18 ^{***}	.18 [*]	.11	.18 ^{***}
Money	.20 [*]	.43 ^{***}	.15 [*]	.27 ^{***}	.24 ^{***}
Create	.24 [*]	.30 ^{***}	.09	.08	.30 ^{***}
FES-Achievement	.11	.11 ⁺	.27 ^{***}	.26 ^{***}	.13 ⁺

Note. FES = Family Environment Scale.

Partial correlations control for family socioeconomic status, subject gender, and subject age.

⁺ p < .10.

^{*} p < .05.

^{**} p < .01.

^{***} p < .001.

Table 3

Bivariate Correlations Between Cognitive Reward Responses, Attainment-Achievement Attitudes, and Mania Risk

	Self-focused rumination	Upward generalization	Goal-attainment attitudes	Achievement attitudes
Mania risk	.22**	.44***	.15*	.22**
Self-focused rumination	—	.36***	.33***	.26***
Upward generalization		—	.25***	.28***
Goal-attainment attitudes			—	.41***
Achievement attitudes				—

Note.

*
p < .05.

**
p < .01.

p < .001.