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BRIEF REPORT

Feeling Good and Taking a Chance? Associations of Hypomania Risk with Cognitive and Behavioral Risk Taking

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Abstract Although elevated impulsivity among individuals at risk for or with a clinical history of mania has been identified in prior work, questions remain regarding ways in which impulsivity may manifest as risky decision-making and behavior. The present investigation examined how hypomania risk, measured using the Hypomanic Personality Scale, was associated with two facets of risk-taking: cognitive appraisals of risks and benefits that will result from risk-taking, and behavioral risk-taking on a validated task and self-report measures. Hypomania risk was associated with appraising future risk-taking as having less costs, but was unrelated to appraising future risk-taking as having more benefits. On behavioral risk measures, it was associated with increased expectations of engagement in risky behavior over the next 6 months, yet also with markers of lower risk-taking on the BART. The present findings have implications for understanding precise cognitive and behavioral factors that underlie the relationship between hypomania risk and risk-taking.

Keywords Hypomania risk · Positive emotion · Impulsivity · Risk-taking

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Introduction

Within the field of emotion and psychopathology, much of the existing work has directed attention toward negative emotion disturbance. However, emerging work has revealed the importance of examining how positive emotion relates to maladaptive physical and mental health outcomes (e.g., Gruber 2011; Gruber et al. 2008, 2011), particularly when positive emotion is experienced at an intensity or duration that does not fit the context in which it occurs (Gruber 2011). Positive emotion states increase the likelihood that some individuals will engage in risky behavior (e.g., substance use and binge-eating; Cyders and Smith 2008). Therefore, it is important to advance our understanding of how positive emotion leads to risky behavior, particularly among individuals for whom this risky behavior often becomes most problematic (e.g., individuals at risk for or with a clinical diagnosis).

Mania is defined by cardinal symptoms of a distinct period of persistently elevated, expansive, or irritable mood (American Psychiatric Association 2000). Patients with a clinical history of mania (i.e., diagnosis of bipolar disorder) often exhibit higher impulsivity according to self-report measures, both during manic (e.g., Strakowski et al. 2010; Swann et al. 2003) and euthymic (e.g., Reddy et al. 2014; Swann et al. 2001, 2003) phases of the disorder. In addition, prior research found that medicated manic patients, as compared to healthy controls, exhibited poorer performance on a computerized betting task (i.e., choosing "less likely" outcomes on a greater percentage of the trials), which indicates a greater tendency toward risk-taking (Murphy et al. 2001). However, it is often difficult to identify heightened impulsivity on behavioral tasks among individuals with bipolar disorder (BD) when assessed outside of a manic episode (e.g., Edge et al. 2013; Strakowski et al. 2010).

Prior work using the Balloon Analogue Risk Task (BART; Lejuez et al. 2002) to assess risk-taking in clinical samples found that individuals with BD significantly differ from healthy controls on some aspects of performance, but only among BD patients with a history of alcohol abuse (Holmes et al. 2009). Other work by Reddy et al. (2014) has found that individuals with BD, when assessed outside a mood episode, do not significantly differ from healthy controls on BART performance, but that BD patients taking antipsychotic medications were more risk-averse on this task than BD patients not currently taking antipsychotic medications.

Among individuals at risk for mania (Giovanelli et al. 2013; Johnson et al. 2013) and those diagnosed with BD in the inter-episode period (Muhtadie et al. 2014), impulsive tendencies emerge particularly robustly in contexts that foster positive emotion and reward-seeking. Importantly, impulsivity among individuals at risk for or with a clinical history of mania has implications for the development and maintenance of symptoms. Impulsivity and reward-seeking can predict manic onset (e.g., Alloy et al. 2009a, 2009b, 2012; Kwapil et al. 2000) and lower quality of life among individuals with this disorder (Victor et al. 2011).

Although impulsivity appears elevated among individuals at risk for or with a clinical history of mania, important questions remain regarding how this manifests in aspects of everyday risk-taking. How might risk for mania impact one's appraisals of the costs and benefits that will result from risky activities? How does this impact one's likelihood of engaging in risky behavior in everyday life? To date, in the impulsivity literature, it has been difficult to identify the cognitive or behavioral components of impulsivity within bipolar disorder. Although persons with bipolar disorder consistently characterize themselves as impulsive during remission, there are few cognitive or behavioral indices of impulsivity that remain elevated post-remission (Edge et al. 2013; Strakowski et al. 2010).

In addition, less is known about processes related to risk-taking, such as sensation-seeking, within individuals at risk for or with a clinical history of mania (e.g., Bizzarri et al. 2007; Cronin and Zuckerman 1992; Henry et al. 2001; Zuckerman 1985). Although impulsivity and sensation-seeking are correlated, they have been found to represent unique constructs (Barratt and Patton 1983). Across various phases of the disorder, individuals with bipolar disorder have been found to self-report higher sensation-seeking as compared to controls on the disinhibition and boredom susceptibility subscales (Cronin and Zuckerman 1992). Follow-up work in this area suggests that heightened sensation-seeking among individuals with bipolar disorder appears to be primarily among those with a prior or current substance use disorder, rather than temperamental characteristics of bipolar disorder (Bizzarri et al. 2007; Henry et al. 2001).

The present investigation aims to examine the relationship between hypomania risk and risk-taking across two types of assessment: (1) *cognitive* appraisals of the potential costs and benefits that will result from risk-taking, and (2) *behavior* according to a risk-taking task and self-report. This design enabled us to test two primary hypotheses. First, we hypothesized that hypomania risk will be associated with decreased *cognitive* risk appraisals, characterized by anticipating less costs and more benefits to result from engaging in risk-taking. Second, we hypothesized that hypomania risk will be associated with increased *behavioral* risk-taking, as assessed through a self-report of anticipated involvement in future risk-taking and performance on the BART (Lejuez et al. 2002).

Method

All procedures for the study were approved in advance by the Yale University institutional review board. Informed consent was obtained from all individual participants prior to the study.

Participants

The current sample was comprised of 156 adults from the Amazon Mechanical Turk (MTurk) community (see

Table 1 Demographics of the Sample

Demographic variable	
Age (years)	28.92 (11.51)
Female (%)	53.2
Ethnicity	
Caucasian (%)	77.6
Black/African–American (%)	8.3
Asian/Asian–American (%)	10.3
Hispanic/Latino (%)	6.4
Other (%)	3.2
Education (years)	14.58 (2.42)
Single/non partnered (%)	41
Employment	
Full-time (%)	35.9
Part-time (%)	26.3
Unemployed student (%)	21.8
Unemployed non-student (%)	14.7
Retired	1.3

Mean values (with standard deviations), unless otherwise specified, are displayed

Table 1 for detailed demographics). Participants were recruited through the Mturk marketplace. Participation was restricted to individuals living in the United States. The study posting stated that participants would complete a 30-min study examining "feelings and behavioral decision-making," and this would entail participating in a game that involves making decisions in order to earn tokens, as well as completing a series of questionnaires to assess one's personality and individual traits. Previous research has documented that MTurk samples are typically more representative of the US population than are general college samples (Buhrmester et al. 2011), and that they appear to be specifically representative in prevalence of mental health symptoms (Shapiro et al. 2013). Two participants were eliminated for failing both attention check items (e.g., "Some people do not read questions. If you are paying attention, please select two as your answer").

Measures

Hypomania Risk

The Hypomanic Personality Scale (HPS; Eckblad and Chapman 1986) is a well-validated assessment tool of risk for mania or hypomania (Gruber et al. 2008; Kwapil et al. 2000). The HPS is comprised of 48 true/false statements that tap into episodic shifts in emotion (e.g., "I often feel excited and happy for no apparent reason"), energy (e.g., "I often get so happy and energetic that I am almost giddy"), and behavior (e.g., "I often get into excited moods where it's almost impossible for me to stop talking"). Within the present sample, four participants fell within the clinically high-risk group, according to previously established cut-offs (scores $\geq$ 36; Kwapil et al. 2000). HPS scores were used as a continuous variable ($M = 16.19$, $SD = 9.28$), and the scale showed good internal consistency ($\alpha = .90$). The HPS has strong predictive validity of the onset of hypomanic and manic episodes (Eckblad and Chapman 1986; Kwapil et al. 2000), and high HPS scores correspond to high rates of bipolar diagnoses (e.g., Eckblad and Chapman 1986) and current symptoms of mania (Klein et al. 1996). Prior studies have used the HPS as a continuous measure of mania risk in non-clinical samples and have identified findings that parallel those identified in diagnosed bipolar samples for the assessment of cognitive biases, impulsivity, and other personality traits (e.g., Giovanelli et al. 2013; Gruber and Johnson 2009; Jones et al. 2007).

The Cognitive Appraisal of Risky Events (CARE) Scale

The Cognitive Appraisal of Risky Events scale (CARE; Fromme et al. 1997) was used to assess two aspects of risk-taking: (1) *cognitive* risk, using two subscales to assess the degree to which one expects risks and benefits to result from risk-taking, and (2) *behavioral* risk, through one subscale to assess self-reported likelihood of engaging in future risk-taking.

Expected Risks Subscale

The expected risks subscale includes 30 items that assess the perceived costs that could result from various risky activities (e.g., sexual behavior, substance use, aggressive behaviors). For each behavior, the participant is asked, "On a scale of 1 (not at all likely) to 7 (extremely likely), How likely is it that you would experience some negative consequence (e.g., become sick, be injured, embarrassed, lose money, suffer legal consequence, feel bad about yourself) if you were to engage in [this behavior]?" These items were averaged to compute an expected risks score, which had adequate internal validity ($M = 5.18$, $SD = 1.55$, $\alpha = .97$).

Expected Benefits Subscale

The expected benefits subscale follows the same format as the expected risks subscale, but instead asks, "How likely is it that you would experience some positive consequence (e.g., pleasure, win money, feel good about yourself) if you were to engage in [this behavior]?" This subscale had adequate internal validity ($M = 1.74$, $SD = .79$, $\alpha = .87$). The expected risks and expected benefits scales were moderately independent, $r = -.17$, $p = .04$.

Behavioral Risk Subscale

The behavioral risk subscale includes 30 items that assess anticipated future involvement in various risky activities (e.g., sexual behavior, substance use, aggressive behaviors). For each activity, the scale asks the likelihood that the participant will engage in that behavior over the next 6 months on a seven-point likert scale. Items were averaged to compute an expected involvement score, which had adequate internal validity ($M = 1.62$, $SD = .62$, $\alpha = .80$).

Behavioral Risk Task

The BART (adapted from Lejuez et al. 2002) is a well-validated measure to assess risk-taking behavior. BART performance often correlates with engagement in real-world risky activities and risk-related individual difference measures (e.g., impulsivity, sensation seeking; Lejuez et al. 2002). In this untimed task, participants are instructed to inflate virtual balloons in exchange for tokens (i.e., one token earned for each pump). However, they are told that

each balloon has a different and unknown point at which it will explode (with a maximum of eight pumps possible before explosion); if the balloon pops, the participant loses all earned tokens for that balloon. After each pump, participants must decide if they wish to keep pumping (and risk explosion) or stop (and accumulate tokens). Participants are told that the objective of the game is to acquire as many tokens as they can. The tokens had no monetary value. In the present study, participants moved through 15 balloons (trials) at the bottom of the screen in sequential order. The number of pumps it took to explode each balloon was set randomly. Two performance variables were calculated: total number of pumps across all balloons ($M = 52$, $SD = 10.19$) and total number of tokens earned ($M = 33.55$, $SD = 8.72$), which were highly correlated ($r = .63$, $p < .01$).

Positive and Negative Affect (PA and NA)

Current PA and NA were each assessed as potential covariates in order to investigate the influence of hypomania risk independent of current mood state. PA and NA were each assessed using a single item that asked, "How positive [negative] do you feel right now?" on a five-point scale. These items were administered at baseline and after the BART task was completed.

Procedure

All participants completed written informed consent procedures. Next, participants self-reported their state PA and NA using the two single-item measures, described above. Participants then received detailed instructions for the BART task (Lejuez et al. 2002) and completed 15 consecutive trials of this task, which lasted approximately 5 min. After the BART task was completed, participants self-reported current PA and NA again, using the same items. At the very end, participants completed self-report questionnaires of cognitive and behavioral risk-taking (CARE; Fromme et al. 1997) and hypomania risk (HPS; Eckblad and Chapman 1986). Participants were fully debriefed and compensated for their participation.

Results

Data Analysis Plan

The goal of the present study was to examine how hypomania risk related to two cognitive variables: (1) appraisal of costs to result from risk-taking (CARE-costs), and (2) appraisal of benefits to result from risk-taking (CARE-benefits), and three behavior variables: (3) one measure of anticipated involvement in future risk-taking (i.e., CARE-behavior) and (4) two measures of performance on a behavioral risk-taking task (i.e., total tokens earned and total non-adjusted pumps administered on the BART).[1] To do so, five Pearson product moment correlations were computed to assess the relationship between hypomania risk (HPS) and each outcome variable (CARE-costs, CARE-benefits, CARE-behavior, BART tokens, BART pumps).

To control for current mood, parallel analyses were conducted as partial correlations.[2] Baseline measures of current affect were controlled for within analyses that involved BART task outcomes (i.e., BART tokens and pumps). In the event that a participant's mood may have shifted after the BART, we controlled for the post-BART measures of current affect during analyses regarding the CARE questionnaires (i.e., CARE-costs, CARE-benefits, CARE-behavior). For all analyses, alpha was set to .05 with two-tailed tests conducted, and results reported below are prior to controlling for current mood. See Table 2 for results of all statistical analyses, both with and without controlling for current mood, and Table 3 for the results of a multiple regression analysis that jointly examines the associations of hypomania risk, current PA, and current NA with the outcome variables of interest.

As predicted, individuals higher on hypomania risk anticipated significantly fewer costs to result from engaging in risk-taking. Contrary to hypotheses, hypomania risk was not significantly associated with appraisals of benefits to result from engaging in risk-taking. Hypomania risk was associated with both behavior risk-taking outcomes. As predicted, it was associated with increased expected involvement in risk-taking over the next 6 months. It was also associated with less tokens earned on the BART, suggesting poorer performance on this risk-taking task, as well as less pumps administered throughout the task.

Discussion

In order to extend prior work documenting heightened impulsivity among individuals at risk for or with a clinical history of mania (Kwapil et al. 2000; Swann et al. 2001), the present investigation sought to examine precise factors underlying this relationship (i.e., cognitive and behavioral aspects of risk-taking). In support of our hypotheses,

[1] All variables were assessed for skewness and kurtosis and outliers were identified. Kurtotic variables were log-transformed and outliers were winsorized; however, these processes did not change any results. Therefore, all variables were used in their original format.

[2] Linear regressions were run to examine if there was a significant interaction between HPS and current PA scores. It was found that this interaction did not significantly predict any of our outcome variables of interest.

Table 2 Correlations of trait hypomania risk (HPS) with cognitive and behavioral risk taking indices ($N = 156$)

Criterion	r	Partial r (controlling for PA and NA)
Cognitive risk (CARE scale)		
Anticipated risks (CARE)	−.19*	−.19*
Anticipated benefits (CARE)	.14^{+}	.13
Behavioral risk (CARE scale and BART)		
Future risk behavior (CARE)	.23**	.23**
Number of tokens won (BART)	−.17*	−.16*
Total non-adjusted pumps (BART)	−.17*	−.16*

CARE cognitive appraisal of risky events, *BART* balloon analogue risk task

* $p < .05$; ** $p < .01$; $^{+}$ $p < .10$

Table 3 Multiple linear regression jointly assessing the associations of PA, NA, and HPS scores with outcome measures ($N = 156$)

Outcome measure	HPS	Current PA	Current NA
Anticipated risks (CARE)	−.20*	.02	.08
Anticipated rewards (CARE)	.13	−.07	.12
Future risk behavior (CARE)	.23**	−.09	.05
Number of tokens won (BART)	−.16*	−.08	.06

Reported beta values are standardized coefficients

CARE cognitive appraisal of risky events, *BART* balloon analogue risk task, *HPS* hypomanic personality scale, *PA* positive affect, *NA* negative affect

* $p < .05$; ** $p < .01$

hypomania risk was associated with anticipating less costs to result from engaging in risk-taking. Contrary to our hypotheses, hypomania risk was not associated with anticipating more benefits to result from future engagement in risk-taking, although we observed a non-significant trend in the predicted direction. This is somewhat surprising given prior work suggesting heightened reward reactivity among individuals at risk for or with a clinical history of mania (e.g., Gruber 2011; Johnson et al. 2012, 2013).

However, upon closer examination, it seems the measure that yielded this current finding (i.e., the benefits subscale of the CARE) captures the construct of sensation-seeking more than reward reactivity. Many of the risky behaviors listed within the scale (e.g., hitting someone with a weapon or object, damaging/destroying public property) seem unlikely to confer any rewards, and are perhaps more likely driven by traits like sensation-seeking. Indeed, this expected benefits subscale of the CARE is positively correlated with sensation-seeking in prior research (Fromme et al. 1997). Existing work on sensation-seeking has found that particular facets of this construct (i.e., disinhibition, boredom susceptibility) are heightened among individuals with BD (Cronin and Zuckerman 1992); however, other work suggests this is primarily only among those with a history of substance abuse (Bizzarri et al. 2007; Henry et al. 2001). Given that the relationship between sensation-seeking and hypomania risk remains relatively understudied, the current findings may help to advance our understanding of this construct that is related, yet distinct from, impulsivity and reward-sensitivity.

Regarding behavioral risk-taking, a self-report assessment of behavior supported our hypotheses, in that hypomania risk was associated with anticipating increased engagement in future risk-taking. This finding is in line with prior work suggesting that individuals at risk for or with a clinical history of mania report heightened BAS sensitivity and engagement in fun-seeking behaviors (Johnson et al. 2013; Meyer et al. 2001). However, the present findings were a bit more mixed when risk-taking was assessed using a behavioral task (i.e., the BART; Lejuez et al. 2002). Hypomania risk symptoms were associated with poorer performance on this task (i.e., less tokens earned). However, it is interesting that within the present study, hypomania risk was also associated with administering *less* total pumps throughout the task, whereas *more* pumps on the BART is typically associated with heightened impulsivity and risk-taking (Lejuez et al. 2002).

These findings are puzzling, though consistent with one prior study in which individuals with a clinical history of mania exhibited less risky behavior on the BART as compared to a healthy control group (Cole 2009). The current results are also somewhat consistent with recent work suggesting although mania is associated with heightened impulsivity on self-report measures, this does not necessarily translate to more impulsive behavior on the BART (Reddy et al. 2014). This reflects work on

impulsivity more broadly, which has uncovered relatively low correspondence between self-report and behavioral measures of impulsivity (Sharma et al. 2014). Despite a burgeoning literature on impulsivity and related processes in bipolar disorder, several studies have now failed to document behavioral impulsivity or risk-taking during periods of remission (Edge et al. 2013; Strakowski et al. 2010).

In light of these findings, it is worth revisiting recent literature that points toward the need for a more specific model of impulsivity in bipolar disorder, in which impulsivity may be particularly present during positive moods for those with BD (Muhtadie et al. 2014) and those at risk for mania (Giovanelli et al. 2013). It is not clear that the task we employed here was exciting enough to induce a positive mood. In addition, whereas much of the prior work using the BART has offered participants incentives to perform well on the task, participants were not offered any incentives in the present study, and it is possible that risk-taking patterns could be impacted by such incentives. Tasks with larger incentives, those with more of a sense of an initially large and unexpected reward, or those with other ways to create a greater activation of the reward system might be worth pursuing in future research.

There are a few limitations of the present investigation to be considered. First, this study used a non-clinical sample, although hypomania risk was assessed on a continuum using a well-validated measure with excellent predictive validity for future manic episodes (Eckblad and Chapman 1986), which has been used in prior research to examine the link between mania proneness and various outcomes (e.g., Giovanelli et al. 2013; Gruber and Johnson 2009). It is of note that there was a rather small number of individuals in the present study that met previously established thresholds for a "high risk" group (Kwapil et al. 2000), which may have limited our ability to detect effects. Further research is needed to determine how the present findings generalize to a clinical sample. Second, our assessments relied on self-report and a somewhat artificial risk-taking task (i.e., the BART). In future studies, it will be important to examine risky behavior in more naturalistic settings, as the present findings may not entirely reflect everyday spontaneous decisions about risk-taking. In addition, whereas much of the prior work using the BART has offered participants incentives to perform well on the task, participants were not offered any incentives in the present study, and it is possible that risk-taking patterns could be impacted by such incentives (Bornovalova et al. 2009). Further, an online version of the BART task used in the present research did not collect information regarding balloon explosions. Therefore, we were not able to use the most commonly used marker of risk-taking on the BART (i.e., adjusted number of pumps). Although prior research suggests that adjusted and non-adjusted number of pumps typically yield nearly identical findings (Lejuez et al. 2002), future studies would ideally include adjusted number of pumps as an important outcome variable. Lastly, it is of note that all analyses were correlational, and therefore, causation cannot be inferred.

The present findings take a step towards more closely understanding the nuances of how heightened risk-taking may manifest among individuals at greater risk for mania. Our findings suggest that hypomania risk is associated with an increased likelihood of future risk-taking and a tendency to anticipate less costs to result from risky behavior. This appraisal of lower costs may play an important role in promoting impulsive and sometimes dangerous behavior among individuals at risk for or with a clinical history of mania. Therefore, formulating realistic predictions of potential costs may serve as an important cognitive intervention when attempting to reduce risk-taking within this population.

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Conflict of Interest Hillary Devlin, Sheri Johnson, and June Gruber declare that they have no conflict of interest.

Informed Consent All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (national and by the Yale University institutional review board). Informed consent was obtained from all participants prior to the study.

Animal Rights No animal studies were carried out by the authors for this article.

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