Looking for bipolar spectrum psychopathology: identification and expression in daily life

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Abstract:

Objectives

Current clinical and epidemiological research provides support for a continuum of bipolar psychopathology: a bipolar spectrum that ranges from subclinical manifestations to full-blown bipolar disorders. Examining subthreshold bipolar symptoms may identify individuals at risk for clinical disorders, promote early interventions and monitoring, and increase the likelihood of appropriate treatment. The present studies examined the construct validity of bipolar spectrum psychopathology using the Hypomanic Personality Scale.

Methods

Study 1 used interview and questionnaire measures of bipolar spectrum psychopathology in a sample of 145 nonclinically ascertained young adults. Study 2 assessed the expression of the bipolar spectrum in daily life using experience sampling methodology in the same sample.

Results

In study 1, Hypomanic Personality Scale scores were positively associated with clinical bipolar disorders, bipolar spectrum disorders, the presence of hypomania or hyperthymia, depressive symptoms, poor psychosocial functioning, cyclothymia, irritability, and symptoms of borderline personality disorder. In study 2, bipolar spectrum psychopathology was associated with negative affect, thought disturbance, risky behavior, and measures of grandiosity. These findings remained independent of clinical bipolar disorders.

Conclusions

In the present studies, bipolar-like disruptions in cognition, affect, and behavior were not limited to clinical diagnoses or mood episodes, providing further validation of the bipolar spectrum construct. The bipolar spectrum model appears to provide a conceptually richer basis for understanding and ultimately treating bipolar psychopathology than current diagnostic formulations.

Recent literature supports a broad spectrum of bipolar psychopathology [1], [2], [3], [4] and [5]. This spectrum includes but extends beyond bipolar diagnoses listed in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR[6]). The present studies examined the construct validity of bipolar spectrum psychopathology in a nonclinically ascertained sample of young adults. Study 1 used interview and questionnaire measures of bipolar spectrum psychopathology, and study 2 assessed the expression of the bipolar spectrum in daily life using experience sampling methodology (ESM).

Keywords: psychology | bipolar disorder | psychopathology | Hypomanic Personality Scale

Article:

1. A broader spectrum of bipolar psychopathology?

Recent reports of the lifetime prevalence of bipolar disorder estimate that 2% of the population qualify for bipolar I and II disorders [7]. Bipolar disorders are a leading cause of premature mortality (largely from suicide and accidental death) and are associated with significant impairment in functioning [8], [9], [10] and [11]. However, there is considerable epidemiological and clinical evidence to support a wider bipolar spectrum that extends beyond the boundaries of the DSM-IV-TR and is associated with impairment and distress. For example, Akiskal [4] proposed additional bipolar diagnoses including bipolar II 1/2 (major depression superimposed on cyclothymic temperament), bipolar III (major depression plus hypomania resulting from somatic treatment), and bipolar IV (major depression superimposed on hyperthymic temperament). Consistent with the DSM-IV-TR, the conditions of Akiskal represent discrete diagnostic categories.

However, clinical and research findings suggest that categorical diagnostic systems may be too stringent to detect bipolar psychopathology in the general population, particularly among adolescents and young adults (eg, Angst et al [5]). Using data from a prospective 20-year community study of young adults, Angst et al [5]found that 9% of their sample met criteria for subthreshold bipolar symptoms, indicating that there are clinically relevant symptoms of bipolar disorder that do not fall within current diagnostic nomenclature and, therefore, may not be recognized or treated in clinical practice. Angst [12] described hypomanic episodes lasting shorter than the 4-day duration in the DSM-IV-TR that were associated with impairment and risk for developing bipolar disorders. Furthermore, Judd and Akiskal [13] found that individuals with histories of manic episodes, hypomanic episodes, or subthreshold symptoms exhibited impaired functioning and increased use of mental health services compared with control participants. Merikangas et al [7] included subthreshold bipolar disorder as part of the National Comorbidity Replication Study. Of the 9282 adults surveyed, 2% met criteria for lifetime subthreshold bipolar

disorder. Moreover, 46% of the subthreshold group reported impairment in the past year. Thus, subthreshold bipolarity is a significant public health concern and heralds risk for the development of bipolar disorders.

Akiskal [4] suggested that 30% to 70% of patients with unipolar depression fall within his extended range of bipolar disorders. This finding, albeit controversial, suggests that bipolar disorders are more common than expected and often misdiagnosed as unipolar depression. Broadening the diagnostic criteria has important implications for understanding etiology, developmental trajectories, and treatment of mood disorders. Examining subthreshold bipolar symptoms may identify individuals at risk for clinical disorders, promote early intervention, and increase the likelihood of patients receiving appropriate treatment [14].

2. Characteristics of bipolar spectrum psychopathology

Whether defined narrowly (eg, DSM-IV-TR) or broadly (eg, the current subclinical and clinical conceptualizations), bipolar spectrum psychopathology involves dysregulation in mood, cognition, and behavior. With regard to mood, bipolar spectrum psychopathology is characterized by extreme manifestations of euphoria, dysphoria, and irritability as well as lability of affect [6]. Disruptions in cognition include changes in form of thought, such as racing thoughts and fullness of thought, as well as in content of thought, such as grandiosity and numerous (often unrealistic) plans. Behavioral and somatic changes include increased energy and sociability, behavioral disinhibition and impulsivity, and decreased need for sleep.

Research has also considered the extent to which bipolar symptoms are episodic or trait like. Akiskal et al suggested that 4 affective temperaments underlie bipolar spectrum psychopathology [15], [16] and [17]: hyperthymia, dysthymia, cyclothymia, and irritability. The DSM-IV-TR partially recognizes the expression of cyclothymia and dysthymia (although the diagnoses do not map on perfectly to the formulations of Akiskal et al). The inclusion of these diagnoses suggests that some people are likely to experience trait-like mood symptoms—although the DSM-IV-TR classifies cyclothymia and dysthymia as episodic Axis I disorders rather than temperaments. The irritable temperament per se is not included in the DSM-IV-TR, although it is associated with both bipolar and borderline personality disorders [[17], [18] and [19]].

Angst [20] included borderline personality disorder as part of the bipolar spectrum, suggesting that it is an intermediate step between subthreshold bipolar disorders and affective temperaments. Angst contended, however, that the relation of personality disorders to bipolar disorders remains unclear and warrants further study. A review of the phenomenology of borderline personality and bipolar disorders suggests that they are overlapping yet distinct constructs, sharing features of affective dysregulation and impulsivity [21].

3. Assessment of bipolar spectrum psychopathology

Assessment and validation of a broader spectrum of bipolar psychopathology have proven difficult, in part, due to a lack of reliable instruments. The self-report Hypomanic Personality Scale (HPS [22]) offers a promising point of entry for studying the construct. The scale, which was designed to identify individuals at risk for bipolar disorders, assesses mild, trait-like manic

functioning. Eckblad and Chapman [22] indicated that 77% of high HPS scorers met criteria for a hypomanic episode compared with none of the control participants. A 13-year follow-up of this sample [23] reported that 28% of the HPS group met criteria for a hypomanic episode within the past 2 years, compared with 3% of the control group. Furthermore, 25% of the HPS group and none of the control group met criteria for bipolar disorders. Subsequent studies (eg, Meyer and Hautzinger [24], Hofmann and Meyer [25], and Johnson and Jones [26]) have supported the validity of the HPS as a screening measure of bipolar spectrum psychopathology.

4. Expression of bipolar spectrum psychopathology in daily life

One way to enhance understanding of bipolar spectrum psychopathology is to examine its expression in daily life. Researchers have recently begun using ESM to examine the expression of clinical and subclinical psychopathology in daily life (eg, Myin-Germeys et al [27] and Brown et al [28]). Experience sampling methodology is a widely used, within-day, self-assessment technique in which participants are prompted at random intervals to complete brief questionnaires. Experience sampling methodology offers several advantages to traditional data collection procedures (eg, Csikszentmihalyi and Larson [29] and deVries [30]). Specifically, ESM (1) repeatedly assesses participants in their normal daily environment, thereby enhancing ecological validity; (2) assesses the participants' experiences at the time of the signal, thereby minimizing retrospective bias; (3) allows for an examination of the context of participants' experiences; and (4) allows for the use of sophisticated multilevel modeling.

Few research studies have examined the expression of bipolar spectrum psychopathology in daily life. Havermans et al [31] investigated the experience of daily uplifts and hassles within a sample of remitted bipolar patients using ESM. The stress of negative events was positively related to both depression and the number of previous episodes of depression. Similarly, Myin-Germeys et al [32] assessed emotional reactivity to daily stress in patients with nonaffective psychosis, bipolar disorder, and major depressive disorder. Patients with major depression experienced increased negative affect in response to stress, whereas patients with bipolar disorder experienced a greater decrease in positive affect in relation to stress.

Kwapil et al [33] examined the expression of bipolar spectrum psychopathology (as measured by the HPS) in daily life using ESM in a sample of 321 nonclinically ascertained young adults. They found that bipolar spectrum psychopathology was associated with elevated euphoria, energy, dysphoria, irritability, flight of ideas, grandiosity, and risky behavior in daily life. They also differentiated the experience of concentration difficulties, which increased across the day for both high and low HPS scorers, and flight of ideas/fullness of thought, which was unique to high HPS scorers and stayed constant across the day. However, they suggested that this was a preliminary study and noted several limitations. Experience sampling methodology data collection was completed up to 12 weeks after the HPS was administered. Although the scale was designed to measure stable characteristics and has good test-retest reliability across this time frame [22], it was not possible to confirm that participants' HPS scores represented their functioning at the time of the ESM study. The study also did not include diagnostic interviews of the participants.

5. Goals of the present studies

The present research examined the construct validity of bipolar spectrum psychopathology as identified by the HPS in a nonclinically ascertained sample of young adults. Study 1 used interview and questionnaire measures of bipolar spectrum psychopathology, and study 2 assessed the expression of the bipolar spectrum in daily life using ESM in the same sample. The construct of bipolar spectrum psychopathology indicates that bipolar characteristics should be identifiable in people who do not have diagnosable bipolar disorders. Therefore, significant associations of the HPS with these characteristics were recomputed after omitting any participants with DSM-IV-TR bipolar disorders to examine whether the effects remained independent of bipolar diagnoses. Specific goals, hypotheses, and methods are described in the subsequent sections. Given that bipolar disorders are equally common among men and women and that there is not a consistent literature on differential expression of bipolar psychopathology among men and women, hypotheses regarding sex differences were not offered.

6. Study 1

6.1. Goals and hypotheses

Study 1 examined the relation of bipolar spectrum psychopathology (as measured by the HPS) with interview and questionnaire measures of psychopathology, personality, and functioning. It was hypothesized that HPS scores would be associated with lifetime diagnoses of DSM-IV-TR bipolar episodes and disorders and the bipolar spectrum disorders of Akiskal [4] as well as global ratings of impaired functioning. Bipolar spectrum psychopathology was hypothesized to be associated with interview-based ratings of borderline personality disorder symptoms, increased substance use and abuse, history of treatment of bipolar psychopathology, and family history of bipolar disorders. On the questionnaire measures, it was hypothesized that bipolar spectrum psychopathology would be associated with affective temperaments of hyperthymia, cyclothymia, and irritability; with personality domains of extraversion and openness to experience; and with impulsivity. We expected these findings to remain when participants with DSM-IV-TR bipolar disorders were removed from the analyses, consistent with a spectrum model. Note that we hypothesized that bipolar spectrum psychopathology would be associated with depressive symptoms but that this relation would not remain significant after omitting participants with DSM-IV-TR bipolar disorders.

7. Method

7.1. Participants

Approximately 1200 students enrolled in general psychology courses completed the HPS in mass-screening sessions during 3 consecutive semesters. College students are an appropriate sample for examining bipolar characteristics, given that bipolar psychopathology frequently first emerges in late adolescence and early adulthood [6] (the age of the sample in the present study), rates of bipolar disorder are relatively comparable among college-educated and non–college-

educated samples [34], and numerous studies have examined bipolar characteristics in student samples (eg, Meyer and Hautzinger [24]). A total of 191 students were invited to participate in study 1. Specifically, all of the mass-screening participants who scored at least 1.5 SD above the mean on the HPS and a comparable number of randomly selected participants who scored less than 1.5 SD above the mean were invited to participate. This recruitment strategy was designed to ensure that a sufficient number of individuals with bipolar spectrum psychopathology were included in the study, while maintaining a continuous distribution. A total of 147 participants took part in study 1 (and, subsequently, in study 2). Two participants were dropped because of invalid questionnaire measures. Neither age nor sex was significantly correlated with HPS scores ($r = -0.09$ and -0.02, respectively). The final sample included 100 women and 45 men. Mean age was 19.5 years (SD, 2.3 years). The sample was 65% white, 16% African American, 4% Hispanic, 4% Asian/Pacific Islander, 4% other, and 7% unspecified.

7.2. Materials and procedures

7.2.1. Mass-screening questionnaires

Mass-screening participants completed a demographic questionnaire, the HPS, and the NEO Five-Factor Inventory (NEO-FFI [35]). Coefficient α for the HPS in study 1 was .93 (see Table 2 for coefficient α values for the remaining scales). The items were intermixed with a 13-item infrequency scale [36]. Participants who endorsed more than 2 infrequency items were dropped from further study. The NEO-FFI is a 60-item self-report measure of the Five-Factor Model of personality.

7.2.2. Structured interview

The interview assessed mood disorders, broader bipolar spectrum disorders, substance use/abuse, psychosocial functioning, borderline personality, mental health treatment, and family history of psychopathology. Interviews were recorded and lasted approximately 90 minutes. Interviews were conducted by 2 advanced clinical psychology graduate students under the supervision of a licensed psychologist. Note that the interviewers were unaware of participants' scores on the HPS. One fifth of the interviews were double rated to assess interrater reliability. The Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (SCID-I [37]) was used to assess current and past mood disorders. Broader bipolar spectrum disorders were diagnosed using the criteria reported in Akiskal [4]. The SCID-I interview was appropriate for determining diagnoses of bipolar II 1/2 and III. Using the criteria of Akiskal [4], participants were interviewed for hyperthymic temperament to determine diagnoses of bipolar IV. The interview assessed substance use using the SCID-I and the scoring system reported in Kwapil [38] that produced quantitative ratings of substance use and impairment. Participants' current functioning was examined using the global assessment of functioning [6]. Borderline personality disorder was assessed using the International Personality Disorder Examination [39].

7.2.3. Self-report questionnaires

After the structured interview, participants completed several self-report questionnaires. The HPS was readministered to examine stability from the initial screening to the time of study 1. The 50-item Temperament Evaluation of Memphis, Pisa, Paris and San Diego Autoquestionnaire (TEMPS-A) [17] was administered to assess affective temperaments. Participants completed the Beck Depression Inventory [40]and the UPPS Impulsivity Scale [41] and [42]. The UPPS is a 46-item scale assessing 4 aspects of impulsivity: urgency, lack of premeditation, lack of perseverance, and sensation seeking.

8. Results

8.1. Hypomanic Personality Scale data

Participants completed the HPS at mass screening and at the time of the interview (2-12 weeks later; mean, 5.5 weeks). Hypomanic Personality Scale scores were examined at both time points (mass screening: mean, 22.6; SD, 11.0; range, 3-42; interview: mean, 17.5; SD, 10.0; range, 0-41). The lower mean HPS score at the second assessment likely reflected regression to the mean (given the selection procedure). Hypomanic Personality Scale scores were strongly correlated across the 2 time points (intraclass correlation, 0.85; $P < .001$), consistent with the test-retest reliability of Eckblad and Chapman [22] of 0.81 across 15 weeks. Therefore, participants were assigned an average HPS score that was used for all subsequent analyses. Note that the results were unchanged when using the average or individual scores.

8.2. Relation of bipolar spectrum psychopathology with interview and questionnaire measures

Thirty interviews (21%) were independently rated by both interviewers to assess interrater reliability. Intraclass correlations using 2-way mixed models for absolute agreement for single ratings were computed for continuous measures including: global functioning, 0.82; borderline symptoms, 0.84; alcohol use, 0.97; and drug use, 0.99. κ Was computed for dichotomous measures including: DSM-IV-TR bipolar diagnoses, 1.00; bipolar spectrum diagnoses, 1.00; interview-rated hyperthymia, 0.83; and major depressive episodes, 0.92.

Binary logistic regression was used to examine the relation of the HPS with dichotomous measures, such as diagnoses. Pearson correlations were used to analyze the relation of the HPS with questionnaire and quantitative interview variables. To determine whether significant findings simply resulted from including participants with DSM-IV-TR bipolar disorders, analyses were recomputed with those participants omitted (with the obvious exception of analyses in which bipolar disorders were the criteria). Note that, in all but 3 analyses, the results remained significant when bipolar patients were omitted, suggesting that the findings were not simply due to the inclusion of a few diagnosed patients.

Table 1 presents the associations of HPS scores with dichotomous indicators of bipolar psychopathology, treatment, and family history. Fifteen (10%) of the participants met criteria for a DSM-IV-TR bipolar disorder (3 with bipolar I, 6 with bipolar II, 1 with cyclothymic, and 5 with bipolar not otherwise specified [NOS] disorders). Six additional participants qualified for

bipolar IV; and 1, for bipolar II 1/2 disorders. Hypomanic Personality Scale scores were significantly associated with interview ratings of DSM-IV-TR bipolar disorders, the bipolar spectrum disorders of Akiskal [4], and history of hypomania or hyperthymia. Note that 20 of the 22 participants with diagnosable bipolar spectrum disorders scored at least 1.5 SD above the mean on the HPS. The relation of the HPS with history of major depressive episodes was not significant (despite the fact that major depressive episodes are part of many of the bipolar disorders). Likewise, relations with treatment or family history of mania or mood disorder were not significant.

Table 1. Binary logistic regressions examining the relation of HPS scores with mood disorders, treatment, and family history

Criterion	% of sample	Prediction by the HPS	
		Odds ratios	95% confidence interval
DSM bipolar disorders	10.2%	1.11□□	1.04-1.19
Broad bipolar disorders	15.0%	1.15□□□	1.08-1.23
Hypomania or hyperthymia	25.2%	1.19□□□	1.12-1.27
Major depressive episode	29.9%	1.02	0.98-1.05
Treatment of bipolar disorder	1.4%	1.10	0.93-1.30
Treatment of mood disorder	15.0%	1.01	0.97-1.06
Family history of bipolar disorder	7.5%	0.99	0.93-1.05
Family history of mood disorder	40.8%	1.00	0.97-1.03

DSM indicates Diagnostic and Statistical Manual of Mental Disorders.

P < .01.

P < .001.

Table 2 presents descriptive data for quantitative measures of personality, psychopathology, and functioning as well as correlations with bipolar spectrum psychopathology. As hypothesized, bipolar spectrum psychopathology was negatively associated with ratings of psychosocial functioning. The HPS was positively associated with hyperthymic, cyclothymic, and irritable temperament but was unrelated to dysthymic temperament (and only modestly to current depressive symptoms). Bipolar spectrum psychopathology was significantly associated with extraversion (large effect size) and openness (medium effect size) and inversely associated with agreeableness (medium effect size), with a modest direct association with neuroticism and inverse association with conscientiousness. Bipolar spectrum psychopathology was significantly associated with borderline traits (although only 1 participant met diagnostic criteria) as well as urgency, lack of premeditation, and sensation seeking. Surprisingly, bipolar spectrum psychopathology was generally unassociated with substance use, although there was a small association with alcohol impairment. All of the results remained significant after omitting the 15

participants with DSM-IV-TR bipolar disorders from the analyses, with the exception of the modest associations of the HPS with current depressive symptoms, neuroticism, and alcohol impairment.

Table 2. Correlations of HPS with measures of psychopathology, personality, and functioning

Criterion	Mean	SD	Coefficientα[a]	Pearson correlation with the HPS[b]
Beck Depression Inventory—depressive symptoms	4.34	5.70	.89	.17
Global Assessment of Functioning—psychosocial functioning	76.12	12.76	–	**−.30**
TEMPS-A				
Hyperthymia	8.62	2.82	.73	**.54**
Dysthymia	4.61	2.08	.62	−.04
Cyclothymia	4.62	3.94	.84	**.52**
Irritability	1.57	1.92	.73	**.31**
NEO-FFI				
Neuroticism	23.08	9.61	.88	.18
Extraversion	32.10	6.41	.77	**.51**
Openness	28.24	6.95	.76	**.32**
Agreeableness	30.05	6.26	.73	**−.38**
Conscientiousness	30.48	7.14	.82	−.22
International Personality Disorder Examination borderline dimensional score	1.50	2.29	–	**.36**
UPPS impulsivity				
Lack of premeditation	2.02	0.56	.89	**.30**
Urgency	2.20	0.58	.87	**.41**
Sensation seeking	2.82	0.63	.87	**.34**
Lack of perseverance	1.93	0.51	.86	.01
Heaviest alcohol use	4.66	5.85	–	.16
Heaviest alcohol impairment	0.88	0.86	–	.17
Heaviest substance use	1.88	3.90	–	.16
Heaviest substance impairment	0.59	0.98	–	.15

P < .05.

P < .01.

P < .001.
a
Coefficient α reported for questionnaire measures.
b
Medium effect sizes in bold, large effect sizes in bold and italics.

8.3. Summary of study 1

As hypothesized, the HPS was associated with measures of psychopathology, personality, and functioning, including interview ratings of bipolar disorders. Note that the odds ratios were relatively modest, but this must be tempered by the fact that the study uses a nonclinically ascertained sample and the fact that the participants still have a considerable period of risk remaining for developing bipolar disorders. We also found predicted associations with measures of functioning, affective temperaments, and personality. Furthermore, the findings did not appear to be driven by a few markedly impaired participants with DSM-IV-TR bipolar disorders.

9. Study 2

9.1. Goals and hypotheses

Study 2 examined the expression of bipolar spectrum psychopathology, as assessed by the HPS, in daily life using ESM. Table 3 shows hypothesized relations of bipolar spectrum psychopathology with experiences in daily life. The findings were expected to remain independent of DSM-IV-TR bipolar disorders.

Table 3. Expected relations of the HPS with experiences in daily life

ESM criterion	Expected relation with the HPS
Affect	
Measures of positive affect	+
Measures of negative affect	+
Current situation is positive	+
Current situation is stressful	+
Thoughts	
Trouble concentrating	+
Fullness of thought	+
Daydreaming	+
Behavior	
Risky behavior	+
Restless	+
Doing something exciting	+
Doing many things	+
Sense of self in the world	

ESM criterion	Expected relation with the HPS
Measures of grandiosity	+
Uncertain	+
Bored	−

In addition to the direct effects of bipolar spectrum psychopathology on experiences in daily life, it was expected that the HPS would moderate the effects of stress in daily life on behaviors. It was hypothesized that high scorers would be more reactive to the experience of stress in terms of affect, cognition, and behavior. We also examined whether changes in affect and cognition across the day differed across levels of bipolar spectrum psychopathology. Following Kwapil et al [33], it was hypothesized that exuberance would decline across the day in the low HPS scorers relative to the high HPS scorers, although this differential effect was not expected for other forms of affect. Also consistent with Kwapil et al [33], it was hypothesized that concentration difficulties would increase across the day for both high- and low-scoring subjects (with a main effect of higher concentration problems for the high HPS scorers) but that fullness of thought (which is more specific to bipolar spectrum psychopathology) would be elevated in the high HPS scorers but constant across the day in both high and low scorers.

10. Method

10.1. Participants

Participants who completed study 1 took part in study 2. Seven participants were dropped because of failure to complete sufficient ESM protocols (final, n = 138).

10.2. Materials and procedures

The ESM protocol was designed to assess experiences relevant to bipolar spectrum psychopathology (eg, racing thoughts) and contextual factors (stressful situations). The Appendix A lists the ESM items and indices. After the completion of study 1, participants received a personal digital assistant (PDA) and were instructed about ESM procedures. The participants kept the PDAs for 7 days. The PDAs signaled the participants, administered the questionnaires, and time stamped and recorded responses. Participants were signaled to complete ESM questionnaires 8 times daily between noon and midnight. Participants had 3 minutes to initiate responses after the signal. After this time interval (or completion of the questionnaire), the PDA turned off and did not reactivate until the next signal, ensuring that participants did not skip questionnaires and complete them later.

10.3. Statistical method

The analyses examined the association of HPS scores with ESM responses. Experience sampling methodology data have a hierarchical structure in which ESM ratings (level 1) are nested within participants (level 2). Multilevel linear modeling provides a more appropriate method than conventional unilevel analyses for nested data [43] and [44]. The multilevel analyses examined 2

types of relations between the HPS score and experiences in daily life. The first was the intercept of the level 1 criterion, which assessed the independent effects of the level 2 predictor (HPS score) on level 1 dependent measures (ESM ratings in daily life). The intercept, β_0, was computed using the formula $\beta_0 = \gamma_{00} + \gamma_{01}$ (HPS) + μ_0. In this model, γ_{00} is the mean value of the level 1 dependent measure, γ_{01} is the effect of the level 2 HPS predictor, and μ_0 is the residual variance term. The γ_{01} coefficient provides information comparable with the unstandardized regression weight of the level 2 predictor with the level 1 measures.

The second set of analyses examined cross-level interactions of the relation of a level 1 predictor and criterion (eg, stress and irritability) with the level 2 HPS scores. Cross-level interactions [45] tested whether level 1 relations varied as a function of HPS scores. Cross-level interactions were evaluated using the equation $\beta_1 = \gamma_{10} + \gamma_{11}$ (HPS) + μ_1 (in which γ_{10} is the mean value of the level 1 slope, γ_{11} is the effect of the level 2 HPS predictor, and μ_1 is the error term). If the HPS predictor was significant, then it explained variability in the within-person slopes. Note that the γ_{10} coefficient evaluates the strength of the relations of the level 1 predictor and criterion, independent of the level 2 variable. These values provide an effective test of the validity of the ESM assessment, although they are not necessarily related to hypotheses regarding bipolar spectrum psychopathology.

Multilevel analyses were computed with HLM6 (Scientific Software International, Lincolnwood, IL, USA) [46]. Consistent with the recommendation of Luke [44], level 1 predictors were group mean centered, and HPS scores were grand mean centered. Parameter estimates were calculated using robust SEs, following Hox[43].

11. Results

Participants averaged completing 40.4 usable questionnaires (SD, 9.9). Table 4 presents the direct effects of bipolar spectrum psychopathology with affect, thoughts, and behaviors in daily life. As hypothesized, we found positive associations with negative affect, including anger, sadness, irritability, worry, and perceiving one's situation as stressful. The HPS was positively associated with exuberance (ie, energetic enthusiasm) but was not associated with happiness or viewing one's situation as positive. As expected, the HPS was positively associated with measures of thought disturbance in daily life, including trouble concentrating, fullness of thought (eg, racing thoughts, thinking about many things), and daydreaming. In addition, the HPS was associated with risky behavior, restlessness, doing something exciting, and increased activity (eg, doing many things) in daily life.

Table 4. Relation of the HPS with affect, thoughts, and behavior in daily life (n = 138)

ESM criterion	Level 2 predictor HPS (df = 135)
Affect	
Happy	0.005 (SE = 0.008)
Exuberant	0.022 (SE = 0.008)
Angry	0.021 (SE = 0.005)
Sad	0.028 (SE = 0.007)

ESM criterion	Level 2 predictor HPS (df = 135)
Irritable	0.029 (SE = 0.007)
Worried	0.027 (SE = 0.009)
Current situation is positive	0.002 (SE = 0.008)
Current situation is stressful	0.035 (SE = 0.008)
Thoughts	
Trouble concentrating	0.039 (SE = 0.008)
Fullness of thought	0.043 (SE = 0.009)
Daydreaming	0.036 (SE = 0.010)
Behaviors	
Risky behavior	0.021 (SE = 0.004)
Restlessness	0.046 (SE = 0.009)
Doing something exciting	0.016 (SE = 0.006)
Doing many things	0.032 (SE = 0.008)

Values are raw multilevel regression coefficients (and SE).

P < .01.

P < .001

Table 5 presents the direct effects of bipolar spectrum psychopathology with measures of sense of self in the world and social functioning. As expected, the HPS was positively associated with measures of grandiosity—perceiving oneself as the center of attention and as better than others. The HPS was positively associated with optimism but did not account for variance in measures of confidence or success in one's current activity. The HPS was positively associated with feeling uncertain and bored in daily life as well as with preferring to be with others when alone but not with other measures of social functioning.

Table 5. Relation of the HPS with sense of self and social interactions in daily life (n = 138)

ESM level 1 criterion	Level 2 predictor HPS γ_{01} (df = 135)
Sense of self in the world	
Confident	0.015 (SE = 0.009)
Center of attention	0.030 (SE = 0.007)
Optimistic	0.019 (SE = 0.009)
Better than others	0.050 (SE = 0.012)
Successful in current activity	−0.000 (SE = 0.008)
Uncertain	0.028 (SE = 0.009)

ESM level 1 criterion	Level 2 predictor HPS γ_{01} (df = 135)
Bored	0.019 (SE = 0.006)
Social interactions	
Alone[a] at signal	0.002 (SE = 0.001)
When alone	
Prefer to be with others	0.025 (SE = 0.012)
Alone b/c not wanted	0.005 (SE = 0.004)
When with others	
Close to other(s)	0.004 (SE = 0.008)
Like other(s)	−0.002 (SE = 0.006)

Values are raw multilevel regression coefficients (and SE).

P < .05.
P < .01.
P < .001.
a
Item is reverse scored (1, yes [alone]; 2, no [with others]).

Cross-level interactions examined the impact of viewing one's situation as stressful across levels of bipolar spectrum psychopathology (Table 6). Not surprisingly, viewing one's situation as stressful in the moment was associated with all of the ratings of affect, cognition, and behavior. However, bipolar spectrum psychopathology only moderated the relation of stress and doing something exciting. Specifically, as the situation became more stressful, low HPS scorers were less likely to report engaging in an exciting activity in comparison with high HPS scorers (Fig. 1). Stress had less of an effect on low HPS scorers' engagement in exciting activities. Note that the lack of cross-level interactions does not mean that there was not a relation between the HPS and the dependent measure—as noted above, all of these direct effects of the HPS were significant.

Table 6. Cross-level interactions of the HPS and experiences in daily life during stressful situations

ESM level 1 criterion	ESM level 1 predictor	Relation of ESM predictor and criterion γ_{10} (df = 135)	Level 2 predictor HPS γ_{13} (df = 134)
Exuberant	Situation stressful	−0.144 (SE = 0.015)	−0.001 (SE = 0.002)
Sad	Situation stressful	0.207 (SE = 0.017)	0.003 (SE = 0.002)

ESM level 1 criterion	ESM level 1 predictor	Relation of ESM predictor and criterion γ_{10} (df = 135)	Level 2 predictor HPS γ_{13} (df = 134)
Irritable	Situation stressful	0.316 (SE = 0.018)	0.003 (SE = 0.002
Trouble concentrating	Situation stressful	0.253 (SE = 0.017)	−0.003 (SE = 0.002)
Fullness of thought	Situation stressful	0.231 (SE = 0.019)	−0.002 (SE = 0.002)
Risky behavior	Situation stressful	0.102 (SE = 0.015)	−0.001 (SE = 0.001)
Doing something exciting	Situation stressful	−0.203 (SE = 0.020)	0.004 (SE = 0.002)

Values are raw multilevel regression coefficients (and SE).

P < .05.
P < .001.

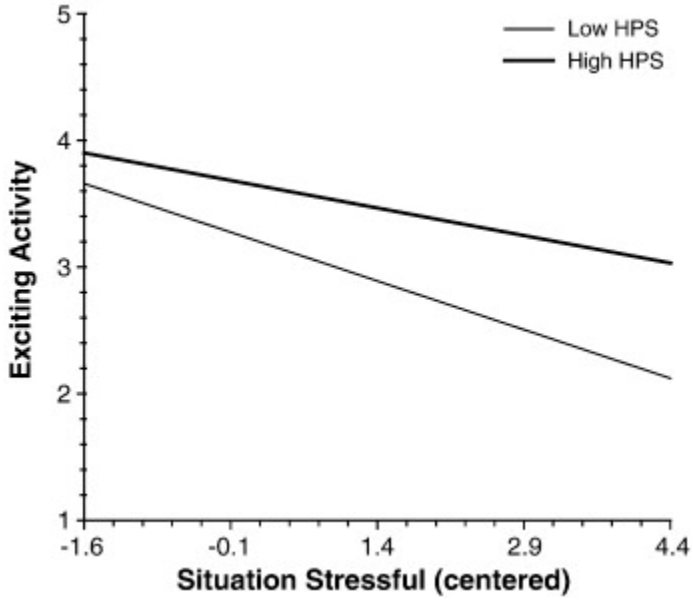

Fig. 1. Cross-level interaction of bipolar spectrum psychopathology with exciting activity and situation stressful.

Cross-level interactions examined whether changes in affect and cognition across the day differed across the bipolar spectrum (Table 7). Overall, reports of exuberance did not change across the day. Consistent with Kwapil et al [33], however, there was a significant cross-level interaction indicating a diverging function such that exuberance tended to increase across the day for high HPS scorers and to decrease across the day for low HPS scorers (Fig. 2). None of the

other cross-level interactions of time and affect were moderated by the HPS. Reports of exciting activities and risky behaviors significantly increased across the day; however, the HPS moderated both of these relations such that high scorers showed a greater increase in risky and exciting behaviors compared with low scorers (Fig. 3).

Table 7. Cross-level interactions of the HPS and changes in experiences in daily life across the day

ESM level 1 criterion	ESM level 1 predictor	Relation of ESM predictor and criterion γ_{10} (df = 135)	Level 2 predictor HPS γ_{13} (df = 134)
Exuberant	Time of day	0.013 (SE = 0.007)	0.002 (SE = 0.001)
Sad	Time of day	0.016 (SE = 0.005)	0.001 (SE = 0.001)
Irritable	Time of day	0.007 (SE = 0.007)	0.001 (SE = 0.001)
Trouble concentrating	Time of day	0.024 (SE = 0.007)	−0.001 (SE = 0.001)
Fullness of thought	Time of day	0.011 (SE = 0.006)	0.001 (SE = 0.001)
Risky behavior	Time of day	0.032 (SE = 0.005)	0.002 (SE = 0.001)
Doing something exciting	Time of day	0.087 (SE = 0.009)	0.002 (SE = 0.001)

Values are raw multilevel regression coefficients (and SE).

P < .05.
P < .01.
P < .001.

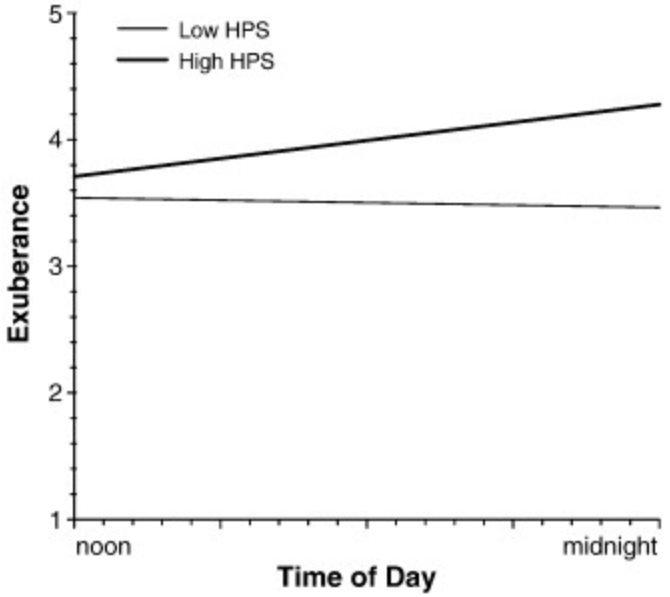

Fig. 2. Cross-level interaction of bipolar spectrum psychopathology with the expression of exuberance across the day.

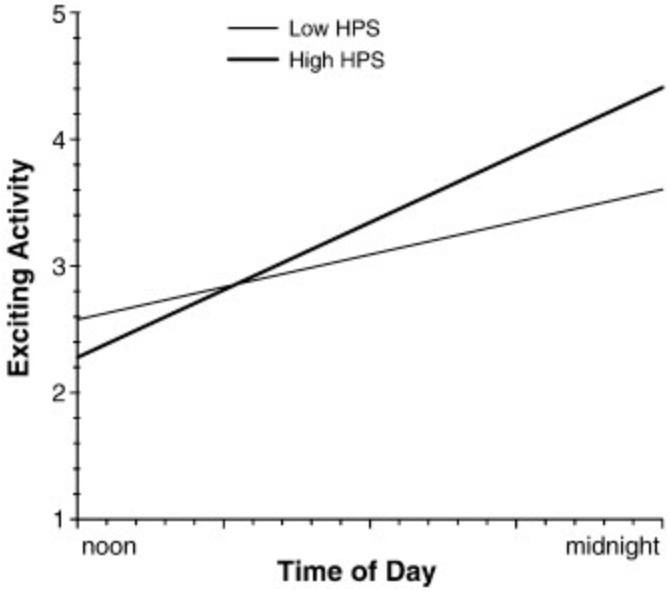

Fig. 3. Cross-level interaction of bipolar spectrum psychopathology with the report of exciting activities across the day.

Difficulty concentrating increased across the day for the entire sample, that is, there was a main effect of higher concentration problems in the high HPS participants relative to the low HPS participants, but their increases across the day in concentration difficulties were comparable. However, fullness of thought, which presumably is more specific to bipolar psychopathology than concentration problems, demonstrated a different pattern. As noted above, there was a main effect of greater fullness of thought in high HPS scorers. However, fullness of thought remained

constant across the day for both high and low HPS scorers. Participants with low HPS scores reported low but increasing concentration problems across the day but did not show increases in fullness of thought. High HPS scorers reported heightened levels of fullness of thought that remained constant across the day. Thus, concentration difficulties increased as the day progressed for all subjects, but elevated fullness of thought was specifically associated with the bipolar spectrum and remained constant throughout the day.

12. Discussion

12.1. Reconsidering traditional views of bipolar psychopathology

Traditional psychiatric literature divides the world into those with bipolar disorders and those without. This categorical system simplifies the diagnosis of bipolar disorders but does not map onto the continuous expression of psychopathology and impairment existing in nature [3] and [47]. The DSM-IV-TR focuses on defining reliable diagnostic categories. As a result, it lacks guidelines for conceptualizing individuals who have bipolar symptoms that do not meet the diagnostic criteria [48]. The current diagnostic system also does not represent the various bipolar disorders as being on a continuum, separated by degree, not type. Therefore, DSM-IV-TR diagnoses offer only a glimpse of bipolar characteristics and may be better conceptualized as classification “short-cuts” than an accurate representation of the broader bipolar spectrum.

12.2. Hypomanic Personality Scale as a measure of bipolar spectrum psychopathology

Construct validation of the bipolar spectrum requires adequate measurement tools. The present studies supported the validity of the HPS as a measure of clinical and subclinical bipolar spectrum psychopathology in a nonclinically ascertained sample. In the first study, the HPS was positively associated with DSM-IV-TRbipolar disorders and the bipolar spectrum disorders of Akiskal as well as a range of subclinical bipolar characteristics and associated traits, including hypomania and hyperthymia, borderline symptoms, cyclothymic temperament, irritability, and depressive symptoms. The present results also suggested that the bipolar spectrum is a heterogeneous construct. Consistent with bipolar disorders, subclinical bipolar characteristics vary broadly across individuals.

This study built on previous cross-sectional (eg, Meyer and Hautzinger [24]) and longitudinal (eg, Kwapil et al[23]) investigations that reported that the HPS predicts bipolar disorders. However, previous validation studies have not fully examined the relation of the HPS with bipolar spectrum characteristics. The present research indicated that the HPS provides a useful “foot in the door” for identifying the bipolar spectrum. The present studies highlighted that the scale measures a wide range of bipolar psychopathology, well beyond initial assumptions that it only measured hypomanic functioning. Furthermore, previous studies of the validity of the HPS were often hampered by the fact that the HPS was administered in screening sessions that were weeks or months before the validity studies. This raised concerns regarding both the stability of the measure and the stability of the construct being assessed (given the cyclical nature of bipolar psychopathology). The present studies addressed this by administering the measure at the initial

screening and the day of the interview and ESM information session. The stability coefficient was high, suggesting that the HPS is a reliable instrument across a 3-month interval and that the construct that it assesses is relatively stable, despite fluctuations in bipolar characteristics.

Hypomanic Personality Scale scores were associated with a history of bipolar disorders. As noted, more than 10% of the sample had a history of DSM-IV-TR bipolar disorders, and the rate increased to 15% when the broader diagnostic categories of Akiskal were considered. However, the association of the HPS with bipolar spectrum psychopathology remained independent of participants with DSM-IV-TR bipolar disorders. Thus, the results were not driven by a subset of disordered participants and support the construct of a broader bipolar spectrum.

The positive relation of HPS scores with borderline traits is consistent with the notion that bipolar and borderline characteristics represent overlapping constructs [21]. Both bipolar and borderline characteristics include labile affect, impulsive behavior, and suicidal gestures. However, bipolar spectrum psychopathology is also associated with changes in cognitions (eg, racing thoughts, fullness of thought) and energy (eg, hypomania, hyperthymia) that fall outside the range of borderline personality disorder.

The finding that HPS scores were not associated with family history of bipolar disorders was contrary to the hypotheses. It is unclear whether this reflects that our assessment method identifies participants with nonfamilial bipolar characteristics or that participants lack knowledge of or are unwilling to divulge family psychopathology. Future studies should include in-depth assessment of family psychopathology including additional informants.

12.3. Expression of the bipolar spectrum in daily life

Study 1 used diagnostic interviews and self-report questionnaires to assess clinical and subclinical bipolar spectrum psychopathology in the laboratory. Study 2 built upon this by examining the expression of the bipolar spectrum in real-world settings—independent of the effects of DSM-IV-TR bipolar disorders. The continuity of findings across the 2 methodologies further supports construct validity of the bipolar spectrum.

Disturbances in thought are a hallmark of bipolar spectrum psychopathology. As expected, bipolar spectrum psychopathology was positively associated with racing thoughts, thinking about many things, daydreaming, and difficulty concentrating. Disruptive behaviors are also associated with bipolar spectrum psychopathology—and are especially problematic during episodes of hypomania and mania. These mood states are often characterized by an increase in goal-directed activity and psychomotor agitation as well as reckless behavior. Bipolar spectrum psychopathology was positively associated with risky behavior, restlessness, exciting activities, and with doing many things in daily life. Bipolar spectrum psychopathology involves marked disruptions in affect, and we found associations with negative affect as well as energy and enthusiasm. Note that the HPS was positively associated with grandiosity and optimism as well as with uncertainty and boredom. These findings highlight that bipolar-like disruptions in cognition, behavior, affect, and sense of self are not limited to clinical episodes, supporting the notion that the bipolar spectrum extends beyond clinical boundaries.

Study 2 also explored the moderating effects of bipolar spectrum psychopathology on the relations of experiences in daily life. In general, bipolar spectrum psychopathology did not

appear to moderate stress reactivity. This may reflect that the main effects on affect, cognition, and behavior in daily life were so robust that they were not differentially impacted by stress. However, the present study replicated findings of Kwapil et al [33] that bipolar spectrum psychopathology moderated the expression of exuberance during the day. Furthermore, it replicated the findings differentiating the experience of ubiquitous concentration difficulties from fullness of thought, which appears to be specific to bipolar spectrum psychopathology.

Experience sampling methodology appears to be an effective method of capturing disruptions in affect, thoughts, behaviors, and sense of self associated with bipolar spectrum psychopathology. Furthermore, ESM data should ultimately allow for more complex relations, such as examining ESM outcomes over longer periods. This technique may be especially useful for assessing bipolar spectrum psychopathology because individuals may cycle in and out of various affective states. In addition, ESM may also be valuable in translational research. For example, ESM may be useful in clinical settings for monitoring bipolar symptoms between appointments.

12.4. Conceptualizing a spectrum of bipolar psychopathology

Conjecturing a bipolar spectrum carries the burden of operationalizing the construct and its boundaries. The bipolar spectrum includes clinical and subclinical expressions of bipolar symptoms, ranging from mild hypomanic episodes and mild hyperthymic or cyclothymic temperament at the low end to severe expressions of bipolar I disorder at the high end. It may best be conceptualized as a constellation of personality and psychopathology characteristics (the extremes of which are represented in DSM-IV-TRdiagnoses). Specifically, the bipolar spectrum involves dysregulation in affect, energy, cognition, and behavior that can be expressed at clinical or subclinical levels. By identifying individuals who experience these subclinical characteristics, we will be better able to understand the nature of the bipolar spectrum as well as factors associated with the etiology and phenomenology of bipolar disorders. Furthermore, studying bipolar spectrum psychopathology will provide insight to the risk and resilience factors associated with the development of bipolar disorders as well as the ways to prevent, assess, and treat bipolar psychopathology.

This model of a bipolar spectrum does not suggest that there is a normal personality dimension of bipolarity—contrasting it from personality dimensions such as extraversion-introversion. Thus, it is not suggesting that everyone falls somewhere along a bipolar continuum. Rather, it suggests that the spectrum represents a confluence of personality and psychopathology factors that will presumably have discernable etiologic pathways. This formulation begs the questions of what are the etiologic pathways and what factors (and to what degree) must be present to be considered as representative of the bipolar spectrum. These questions fall outside the current construct validity study. However, the examination of both clinical features (study 1) and daily life experiences (study 2) provided a unique approach for examining bipolar characteristics, and the current findings are consistent with the idea of a broader bipolar spectrum and support further investigations of etiology.

Bipolar spectrum characteristics and psychopathology are multifaceted. This is apparent in the temperaments of Akiskal, in the cyclical nature of the disorders, and the domains of expression and impairment (elevated and dysphoric affect, form and content of thought, impulsive and

erratic behavior, etc). These findings are suggestive of possible multidimensional formulations. However, such formulations should be based upon a priori theorizing and consider possible etiologic mechanisms and should avoid overinterpreting post hoc groupings of phenomenological characteristics.

Dimensional models of psychopathology are being considered for many other disorders, including schizophrenia (eg, Meehl [49]) and depression (eg, Hankin et al [50]). These models suggest that the clinical disorders are part of a larger spectrum of symptoms and impairment. Patients often exhibit subclinical manifestations before the onset of the disorder, and people with subclinical expressions are presumed to be at heightened risk for transitioning into clinical disorders. However, the bipolar spectrum is relatively unique compared with these other models in that mild manifestations of the bipolar spectrum can be advantageous (although Claridge [51] suggested advantageous aspects of preschizophrenic conditions). Numerous studies[52], [53], [54] and [55] indicated that sporadic hypomania or trait-like hyperthymia can enhance functioning in many domains (albeit conveying heightened risk for mania and depression). Nevertheless, this creates challenges for conceptualizing the spectrum and identifying people who fall on this continuum. Assessment must not simply rely on impairment or dysfunction but also has to identify spectrum characteristics that can be adaptive.
Following Cronbach and Meehl [56], the construct of the bipolar spectrum is at the present time relatively loosely defined. However, the findings provide preliminary support for the conceptualization. Investigation of the issues presented above provides a road map toward operationalizing and testing a more systemized construct. Furthermore, the bipolar spectrum model appears to provide a conceptually richer basis for understanding and ultimately treating bipolar psychopathology than current diagnostic formulations.

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Appendix A. Experience sampling questionnaire

Note: Protocol is presented on a personal digital assistant (PDA). Each question appears on a separate screen on the PDA. Participants only see the nonbolded information and scoring options. Unless otherwise noted, all items are scored from 1 (not at all) to 7 (very much).

1. I feel confident right now.

2. I am doing something exciting right now

3. My thoughts are racing right now.

4. I have trouble concentrating right now.

5. I am thinking about a lot of things right now.

6. I am daydreaming right now.

7. I feel happy right now.

8. I feel bored right now.

9. I feel irritable right now.

10. I am doing something risky right now.

11. I feel sad right now.

12. I feel uncertain right now.

13. I feel enthusiastic right now.

14. I am the center of attention right now.

15. I feel worried right now.

16. I feel restless right now.

17. I am doing something right now that I may regret later.

18. I feel optimistic right now.

19. I feel angry right now.

20. I feel energetic right now.

21. I feel like I am better than most people right now.

22. Are you alone at this time? Yes No

[If with others, no to no. **22):]**

23. I like this person (these people).

24. I feel close to this person (these people).

[If alone, yes to no. **22:]**

25. I am alone right now because people do not want to be with me.

26. Right now I would prefer to be with other people.

[All participants answer:]

27. I am successful in my current activity.

28. I am doing many things right now.

29. My behavior right now could get me into trouble.

30. My current situation is stressful.

31. My current situation is positive.

Indices

1) Exuberance = mean of items 13 and 20

2) Fullness of thought = mean of items 3 and 5

3) Risky behavior = mean of items 10, 17, and 29

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