Examining the Joint Factor Structure of Mania, Internalizing, and Thought Disorder Symptoms in a Large Online Sample

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Abstract

The optimal classification of mania symptoms within dimensional models of psychopathology remains unclear, due in part to most prior research using composite, categorical ratings of mania/bipolar disorder rather than ratings of specific symptoms. We addressed this gap by examining the structure of self-reported symptom-level ratings of mania, internalizing, and thought disorder in adults recruited online who self-identified as having significant mental health histories ($N = 1,112$). Although prior research suggests that mania symptoms overlap strongly with both internalizing and thought disorder, our results indicated much closer alignment with thought disorder than internalizing when examining a two-factor structure. When examining a three-factor structure, ratings of manic symptoms such as grandiosity continued to load strongly onto a common factor with thought disorder symptoms, whereas symptoms such as racing thoughts and excessive energy loaded strongly onto a separate *Agitation* factor. Agitation showed some distinctive external associations with personality and medication use (e.g., with disinhibition, stimulant medication use), but was still strongly correlated with thought disorder. Future research informing the dimensional classification and assessment of mania symptoms can extend our findings by incorporating assessment of other psychopathology (e.g., externalizing), examining the cross-method consistency of results, and determining symptom interrelations using intensive longitudinal designs.

Keywords. bipolar spectrum disorders; dimensional models; classification; assessment; factor analysis.

Limitations of the *Diagnostic and Statistical Manual of Mental Disorders* (currently 5th ed., text rev.; *DSM–5-TR;* American Psychiatric Association [APA], 2022) include poor interrater reliability for many diagnoses, considerable symptom repetition across disorders (e.g., irritability is described as a symptom of many disorders), and within-disorder heterogeneity, among other issues (Forbes, 2023; Kotov et al., 2022). A substantial body of research has focused on examining dimensionally-based models of classification as an alternative to traditional categorical systems to address these issues, and significant progress has been made toward understanding the dimensional classification of many symptom dimensions. Tangible changes to classification and diagnosis informed by dimensionally-based research outside of the DSM framework include the *International Statistical Classification of Diseases* (ICD-11; World Health

Organization, 2019) now using a dimensionally-informed model for personality disorder diagnosis, although adoption of this model was not without controversy (see Campbell et al., 2020 for discussion).

The Hierarchical Taxonomy of Psychopathology (HiTOP; Kotov et al., 2022) also has received significant attention as an alternative, dimensionally-based framework for classifying psychopathology spanning traditional DSM chapters and different forms of psychopathology. From the HiTOP perspective, symptoms are classified dimensionally at multiple levels of specificity (Conway et al., 2022; Kotov et al., 2022). For example, according to the HiTOP, worry is classified as an internalizing spectrum symptom at a broad level and also as a symptom of the distress subspectrum within internalizing at a more specific level of abstraction. Current HiTOP consortium priorities focus on developing a comprehensive, unified set of measures for assessing symptom dimensions spanning different spectra (Simms et al., 2022; also see Ruggero et al., 2019 and Stanton et al., 2020 for review of existing measures available for assessing specific symptom dimensions in a manner consistent with the HiTOP).

However, there are still gaps regarding how some specific symptom dimensions should be classified within the HiTOP, which are necessary to address if the HiTOP is to become a comprehensive model guiding research and practice (Ruggero et al., 2019; Sauer-Zavala, 2022). One key gap is a lack of certainty regarding the optimal classification of manic and hypomanic symptoms characteristic of bipolar spectrum disorders (BSDs) within the HiTOP (Forbes et al., 2021; Ringwald et al, 2023). This includes symptoms described within criterion A and criterion B

for manic episodes, for which criteria are required to be met to diagnose bipolar I disorder according to the DSM (APA, 2022). The DSM criterion A material for manic episodes describes episodic, distinct experiences of symptoms including elevated, expansive, or irritable mood, and increases in energy or activity (APA, 2022, pp. 123-124). Seven additional manic symptoms are described within criterion B, with examples of these symptoms including inflated self-esteem, decreased need for sleep, and pressured speech. The content of the symptom criteria for hypomanic episodes parallels the manic episode criteria, although the DSM describes differences in time course, associated impairment and possible hospitalization, and other features for manic versus hypomanic episodes (abbreviated to "mania" from here on, consistent with terminology used in most HiTOP research; Kotov et al., 2022; also see Kaltenboeck et al., 2016 for detailed review of the DSM criteria for bipolar and related diagnoses).

Manic symptoms currently are thought to overlap strongly with both the thought disorder and internalizing spectra (see Figure 1 of Kotov et al., 2022), but better understanding the classification of manic symptoms is recognized as a HiTOP consortium priority (Ringwald et al., 2023; Watson et al., 2022). It is surprising in some ways that mania symptom classification within dimensional models is not better understood given that BSDs have been widely studied in comorbidity and classification research (Merikangas et al., 2007; Zimmerman & Morgan, 2013). However, most prior work directly examining mania's classification within dimensional psychopathology models assessed mania only at a composite (i.e., a yes/no BSD or mania history) rather than symptom level.

Figure 1. Hierarchical Factor Structure for Models Ranging from One to Three Factors
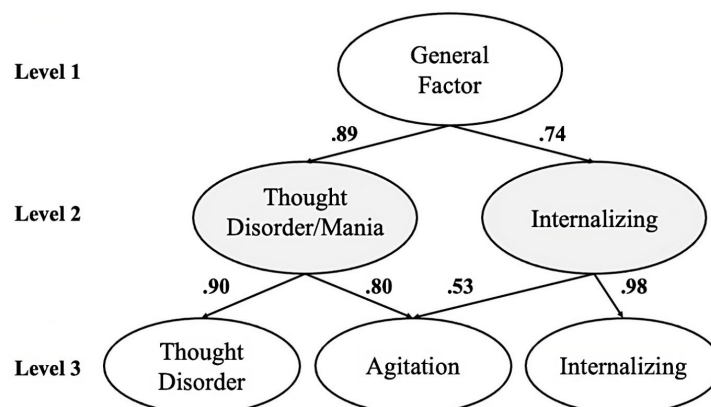
Note. N = 1,112 across all levels of analysis. Only path coefficients > .50 for factors separated by a single level are shown above. Regarding other coefficients, coefficients for the general factor from Level 1 (single-factor solution) with the factors from Level 3 (three-factor solution) were as follows: .77 with Thought Disorder, .83 with Agitation, and .66 with Internalizing. Regarding Level 2 and 3 coefficients not shown above, the coefficient for Thought Disorder/Mania from Level 2 with Internalizing from Level 3 was .25, and the coefficient for Internalizing from Level 2 with Thought Disorder from Level 3 was .24.

This is a critical concern given that the HiTOP's overarching goal is to classify specific, homogeneous symptom dimensions rather than broader composite disorders. The symptom criteria for many categorical disorders are heterogeneous, but this is true for the mania criteria especially. In addition to manic symptoms overlapping with thought disorder and internalizing symptoms, other manic symptoms such as risk taking and distractibility could conceivably be classified as externalizing in nature (Johnson et al., 2012; Prisciandaro et al., 2019). In contrast, symptoms from many other disorders are best classified within one or two existing spectra (e.g., generalized anxiety symptoms within internalizing; Kotov et al., 2022). Furthermore, some of the relatively small number of studies incorporating symptom-level mania assessment used only symptom ratings corresponding with criterion A for mania given that use of interview "skip outs" is common in mania assessment (Markon, 2010; Wright et al., 2013).

The limited research based on more detailed symptom-level assessment indicates that grandiosity and euphoric mood are differentiable from internalizing (Bedford & Deary, 2006; Stanton et al., 2019; 2023) and may be best classified as a subspectrum within thought disorder (Forbes et al., 2021; Reininghaus et al., 2016). It also is possible that manic symptoms such as euphoria may be optimally classified separately from thought disorder within their own mania spectrum; consistent with this, some mania symptoms show associations with reward-based processes, extraversion, and related constructs not shared by most other psychopathology (Kotov et al., 2020; Johnson et al., 2012). Regarding other aspects of mania symptom classification, in perhaps the most comprehensive symptom-level classification study to date, Forbes et al. (2021) found that recklessness, irritability, and distractibility loaded strongly onto a Disinhibited Negative Affect factor within internalizing.

Still, research examining mania symptom-level classification is nascent due to being based on few studies and samples overall. In fact, based on their recent meta-analysis of structural psychopathology research, Ringwald et al. (2023) identified the need for research informing symptom-level classification for mania symptoms specifically. Ringwald et al. (2023) and others (e.g., Forbes et al., 2021) also draw attention to the need to assess symptom dimensions across as many spectra as possible in studies. In addition to previous research focusing mostly on composite mania ratings, a sizeable portion of studies examined mania in relation to a single other HiTOP spectrum. For example, even if symptom-level assessment was incorporated, mania has often been studied in relation to internalizing (e.g., Eaton et al., 2013; Kotov et al., 2015; Stanton et al., 2019) or thought disorder alone (e.g., Reininghaus et al., 2016).

Study Aims: Advancing Understanding of Mania Classification at the Symptom Level

Factor Analyses Informing Dimensional Models

Our study contributes knowledge informing mania classification by conducting joint factor analyses of self-rated manic, internalizing, and thought disorder symptoms. We examined symptom structures in a large sample of 1,112 adults recruited online who self-identified as having a significant mental health history. This included a significant portion of participants who self-identified as having long-term mental health issues resulting in disability.

We focused on analyzing manic symptoms in relation to internalizing and thought disorder symptoms because mania symptoms may overlap most strongly with these spectra theoretically and based on prior research (Keyes et al., 2013; Kotov et al., 2020). We were not able to assess symptoms of other HiTOP spectra here. However, our assessment approach still provides finer-grained, more detailed coverage of manic, internalizing, and thought disorder symptoms than many studies to date, and our analyses were based on items from measures developed specifically for symptom-level assessment (rather than diagnostic level), such as the Expanded Version of the Inventory of Depression and Anxiety Symptoms (IDAS-II; Watson et al., 2012; Stasik-O'Brien et al., 2019). Self-report is viewed with skepticism by some researchers and clinicians, but self-ratings of mania and thought disorder often show at least moderate convergence with interview ratings (Meyer et al., 2020; Williams et al., 2022). Self-report also may be advantageous for assessing internal experiences (i.e., many internalizing symptoms; Vazire, 2010), although we acknowledge that self-report provides only one lens into symptom assessment.

We examined symptom structures at different levels of abstraction (i.e., a single-factor structure, two-factor structure, and so on), consistent with a hierarchical approach for delineating symptom structure (Forbes et al., 2021). Timestamped predictions for all factor analyses made prior to conducting them are available on the Open Science Framework: https://rb.gy/9gp98. We also present these predictions in Online Supplemental Figure S1 (general structural predictions) and Online Supplemental Table S1 (predicted factor loading patterns), recognizing that our hypotheses were tentative given limited symptom-level research to date.

First, we anticipated that most symptom ratings would load strongly onto a common single factor (see

Watts et al., 2020 for issues regarding general factor model interpretation). When examining a two-factor model, we predicted that some manic symptoms such as increased energy and euphoric mood would load strongly onto a Positive Activation factor. We predicted that these symptom ratings would be distinct from internalizing and thought disorder symptoms given that these symptoms show unique positive associations with reward-seeking and extraversion (Johnson et al., 2012). These symptoms have also emerged as distinct from other psychopathology in some studies as reviewed (Bedford & Deary, 2006), again recognizing that the HiTOP still identifies manic symptoms as overlapping substantially with both thought disorder and internalizing based on research to date (Kotov et al., 2020; 2022).

When examining a three-factor model, we predicted that internalizing and thought disorder symptom ratings would load strongly onto separate factors in addition to a Positive Activation factor again emerging. We predicted that some items assessing grandiose cognition (e.g., "having special relationships with famous people") would load more strongly onto a Thought Disorder than Positive Activation factor in the three-factor model, however. Finally, we were uncertain of the extent to which all factors would be well-defined in solutions with four or more factors. We did not make timestamped predictions for these models as a result, but we still examined models with four or more factors to take as comprehensive of an approach as possible.

External Factor Correlates with Personality and Psychiatric Medication Use

We also examined correlates for factors with (a) personality disorder traits and (b) current psychiatric medication use. Predictions for correlations for factors from our three-factor solution, which was the solution we anticipated as having the largest number of well-defined factors as reviewed, also were timestamped. These predicted associations also are available on the Open Science Framework (https://rb.gy/9gp98) and in Online Supplemental Table S2. We cannot review all predictions here due to the large number of correlations examined, and predicted factor associations were dependent on the nature of our emergent factors. Example predictions included Thought Disorder and Positive Activation factors showing weak to moderate positive correlations with antipsychotic and mood stabilizer use, which would be expected theoretically (Waszczuk et al., 2017). We also anticipated that a Thought Disorder factor would correlate positively with use of a range of medications because thought disorder symptoms may represent more severe experiences of psychopathology. Next, we generally

expected that factors would align with personality trait dimensions mirroring their content (e.g., an Internalizing factor with negative affectivity) but assessed at a different timeframe (i.e., symptoms versus traits). Although many of these associations would not be surprising, these correlational analyses help to contextualize the nature of factors from our structural analyses (e.g., if factors show meaningfully different correlates with personality tendencies).

Method

Participants and Procedure

Participants were 1,112 adults recruited through the Prolific crowdsourcing platform. See Online Appendix 1 for additional information regarding missing data and attention checks used to evaluate response validity. To summarize briefly, our original sample size was 1,157 participants, but 45 participants (only 3.9% of the original sample) had their data removed due to failing obvious attention checks, reducing our final sample to 1,112 as noted.

Prolific provides researchers with screening filters so that only select participants can access studies. Participants for this study had to answer "yes" to screening filter questions assessing one or more of the following aspects of mental health history to be eligible to participate: (a) having any diagnosed mental health condition not well-managed by intervention that impacts daily life, (b) having a currently or previously diagnosed mental health disorder, or (c) having a long-term mental health condition resulting in disability. Participant responses to these screening questions on Prolific are not verified by mental health professionals, but we still anticipated that many participants would have significant mental health histories based on use of these filters (Stanton et al., 2022). Consistent with this, a majority of participants were currently accessing treatment for mental health issues (52.6% psychiatric medication; 35.6% psychotherapy). Other sample demographic information is provided in Table 1.

All participants completed the items used in our factor analyses and items assessing medication use that are described subsequently. However, only a subset of 419 participants completed our measure of personality disorder traits due to funding and time constraints. Demographic information was very similar for this subset of participants compared to the overall sample, as Table 1 shows.

Item-Level Assessment of Hypomania, Thought Disorder, and Internalizing

Participants completed items assessing internalizing and mania from the IDAS-II (Watson et al., 2012). This included the 10 IDAS-II Dysphoria scale items assessing a range of internalizing symptoms (e.g., feeling worried, inadequate). The IDAS-II Euphoria (5 items) and Mania (5 items) scale items also were administered to assess a range of mania symptoms such as euphoric mood, grandiosity, increased energy, racing thoughts, pressured speech, and agitation. Participants responded to IDAS-II items in reference to the past 2 weeks on a 5-point scale ranging from 1 (*not at all*) to 5 (*extremely*).

The IDAS-II does not include scales assessing

Table 1. Study Sample Demographic Information

	Overall Sample	Subsample
Age (M & SD)	34.7 (11.8)	35.1 (11.6)
Gender		
Women	55.6	55.6
Men	37.6	39.6
Nonbinary	6.4	4.5
Racial Identity		
White or European American	84.1	87.8
Asian American	7.3	5.7
Black or African American	7.0	4.8
Native American or Alaska Native	3.2	2.4
Middle Eastern and North African descent	1.1	1.0
Native Hawaiian or Pacific Islander	0.3	0.2
Ethnicity		
Hispanic or Latine	8.6	8.4
Education		
Some high school	2.2	2.6
High school/GED equivalent	14.4	13.8
Some college, associate's, vocational	40.3	40.8
Bachelor's degree	32.3	32.0
Advanced degree	10.8	10.5
Psychiatric Treatment Status		
Current Medication	52.6	57.0
Current Psychotherapy	35.6	37.0

Note. N = 1,112 for the overall sample and 419 for the subsample who completed additional measures. In addition to the information for gender shown above, 5.7% of the overall sample participants and 4.5% of the subsample participants were transgender. All values are frequencies except for age. Overall percentages exceed 100% in some cases because participants could select multiple response options when responding to some questions used to obtain the information shown above. Small percentages of participants also provided write-in options in response to specific questions (e.g., for gender).

thought disorder, so we supplemented our factor analyses with 8 items assessing positive psychotic symptoms informed by the content of Zimmerman et al. (2018)'s Clinically Useful Outcome Assessment battery. This included items assessing paranoia (e.g., "thought people were watching me"), dissociation (e.g., "things around me felt unreal"), and visual and auditory hallucinations, as well as grandiosity described as characteristic of both thought disorder and mania (e.g., feeling like one has special abilities). The Clinically Useful Item sets traditionally are administered with instructions referencing the past week. However, we administered these items with the same response format as the IDAS-II items (i.e., 1 – 5 scale; past 2 weeks) to avoid results potentially being driven by differences in administration format. Frequencies for all items are provided in Online Supplemental Table S3. Due to our use of a large clinically-oriented sample, there were at least 80 participants who reported some level of endorsement for all symptom ratings (i.e., a rating higher than *not at all*). In many cases, symptom endorsement levels were high (e.g., the mode response [26.3%] for the item "felt inadequate" was *extremely*, with 23.7% also responding *quite a bit*).

Other Study Measures Used to Examine External Factor Correlates

Information regarding participants' psychiatric medication use is provided in Online Supplemental Table S4. Many participants reported taking antidepressants (41.2%; *n* = 458). Use of other medications relevant to our study aims such as mood stabilizers and antipsychotics were 5.5% (*n* = 61) and 4.9% (*n* = 55), respectively. These rates of mood stabilizer and antipsychotic use exceed estimates from many adult outpatient samples (e.g., 1.7% antipsychotic use rate in outpatient samples according to some estimates; Dennis et al., 2020).

The subset of participants completing a slightly more extensive study protocol were administered the 25-item Personality Inventory for *DSM–5—Brief Form* (PID-5-BF; American Psychiatric Association, 2013) to assess the Alternative *DSM-5* Model for Personality (AMPD) trait domains using 5 items each. Items from the PID-5-BF were not jointly factor analyzed with the symptom ratings described previously because they assess trait ratings. As a result, joint factor analyses including PID-5-BF item scores may have resulted in emergent factors representing differences in administration timeframe rather than theoretically meaningful differences. Participants responded to all PID-5-BF items using a 0 (*very false or often false*) to 3 (*very true or often true*) response format. Descriptive statistics and coefficient omega

values (all omegas > .70) for all PID-5 scales are reported in Online Supplemental Table S4.

Results

Data Analytic Approach

We used an exploratory factor analytic (EFA) approach for sequentially examining factor structures (e.g., examining a one-factor structure, then two factors, and so on). Our predictions were tentative as reviewed, and use of more confirmatory rather than exploratory modeling approaches would have required adjudicating amongst a very large number of model configurations. All EFAs were conducted using principal axis factoring with squared multiple correlations as the initial communality estimates. These EFAs were based on polychoric correlation matrices due to our use of categorical item-level data, and a promax rotation was used when examining EFA models with multiple factors. Consistent with approaches for explicating psychopathology in other studies (e.g., Forbes et al., 2021), we linked factors across solutions by modeling factors using regression-based factor scores and then correlating factors across solutions varying in complexity. We refer to these correlations subsequently as path coefficients, and regression-based factor scores that were derived for these analyses also were used for examining factors' external correlates with personality and medication use. Analyses were conducted using SAS Version 9.4.

Factor Analyses of Mania, Internalizing, and Thought Disorder Symptom Ratings

We aimed to identify the largest number of well-defined, interpretable dimensions in our factor analyses, and we also conducted a parallel analysis to help inform the maximum number of factors to extract. Parallel analysis results indicated that up to three factors could be extracted. Specifically, the third eigenvalue from our data exceeded the randomly generated value from our parallel analysis (1.99 vs. 1.23) but the fourth eigenvalue did not (0.80 versus 1.20).

A hierarchical depiction summarizing these results is shown in Figure 1. First, all items loaded strongly (loadings > .50) onto a single general factor, as shown in Online Supplemental Table S5. Next, two-factor model results are presented in Online Supplemental Table S6. Items assessing euphoric mood, increased energy, increased activity, and thought disorder symptoms (e.g., "saw things"; "thought people were

out to get me") loaded strongly onto a factor we labeled *Thought Disorder/Mania*. Items assessing distress and negative mood (e.g., "felt inadequate") loaded strongly onto a second factor that we labeled *Internalizing*. These two factors were correlated .38. Path coefficients for Thought Disorder/Mania and Internalizing were .89 and .74, respectively, with the factor from the single-factor solution.

Factors loadings for a three-factor solution are shown in Table 2. Thought disorder, grandiosity, and euphoric mood items loaded strongly onto the first factor, similar to the first factor from the two-factor solution (path coefficient = .90). We labeled this factor *Thought Disorder* as a result. An *Internalizing* factor also emerged again (path coefficient = .98 with Internalizing from the two-factor solution). Items assessing racing thoughts, restlessness, increased energy, and racing to different activities loaded strongly onto a third factor we labeled *Agitation*[1]. Agitation's strongest path coefficient was .80 with Thought Disorder/Mania from the two-factor solution. Regarding other details of the three-factor solution, the Thought Disorder factor correlated .57 with Agitation but only .26 with Internalizing; Internalizing and Agitation correlated .35. Additional details of this three-factor solution are presented in Online Supplemental Table S7 to show that our results were highly consistent when altering various aspects of our EFA modeling (e.g., when using a different oblique rotation) and using a different software platform (Mplus Version 8). We took this additional data analytic step based on recommendations by Watts et al. (2023) to examine the robustness of results across chosen approaches for conducting EFAs.

At least one or more factors had few to no strong item markers when examining solutions with four or more factors, which we did not consider further as a result. For example, when examining a four-factor solution, only two items ("saw things that weren't there" and "heard voices or sounds") loaded > .40 on the fourth factor, and these two items also loaded more strongly onto other factors in the four-factor solution.

External Factor Correlates with Personality and Medication Use

Correlations for factors from the one- and two-factor solutions with personality and medication are provided in Table 3. Predictions for these correlations were not preregistered, as we initially focused on examining correlates for factors from the three-factor solution.

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[1] We recognize the arbitrariness of these and other assigned factor labels in some ways, and for this final factor in particular. We also considered other labels such as *Activation* for this factor, a term sometimes used to describe experiences of high-arousal positive mood and goal-directed behavior. Items assessing racing thoughts and restlessness that also loaded strongly onto this third factor did not seem consistent with the term Activation, however, which is why we opted for the label *Agitation* instead.

Table 2. Standardized Factor Loadings for the Three-Factor Solution

Item	Thought Disorder	Internalizing	Agitation
Saw things that weren't really there	**.90**	.09	-.13
Heard voices or sounds	**.85**	.17	-.16
Thought I had special relationships	**.82**	-.09	.06
Thought people were out to get me	**.76**	.27	-.03
Felt I had supernatural powers	**.72**	-.07	.09
Felt "on top of the world"	**.66**	-.37	.32
Thought people were watching me	**.64**	.28	-.03
Felt elated for no reason	**.58**	-.07	.39
Felt I could do amazing things	**.57**	-.18	.28
Things felt unreal or more real	**.54**	.32	.07
Talked more slowly	**.53**	.32	.05
Felt discouraged about things	-.10	**.89**	.04
Felt inadequate	-.08	**.87**	.02
Felt depressed	.08	**.85**	-.11
Little interest in usual activities	.11	**.78**	-.04
Blamed myself for things	.04	**.77**	.07
Was worried all of the time	-.02	**.72**	.14
Had trouble concentrating	-.02	**.56**	.34
Couldn't make up my mind	.09	**.48**	.29
"Zoned out" a lot	.21	.39	.32
My thoughts jumped rapidly	-.06	.17	**.85**
Thoughts raced very quickly	.00	.16	**.82**
Felt like my mind was racing	-.06	.20	**.79**
Had so much energy	.23	-.14	**.73**
Felt fidgety, restless	-.08	.23	**.71**
Kept racing to different activities	.12	.09	**.69**
Had much more energy	.41	-.27	**.59**
Spoke very rapidly	.32	.16	.45

Note. $N = 1,112$. Factor loadings ≥ .50 are **bolded**. All items assessed symptoms in reference to the past 2 weeks.

Correlates for those three factors initially were deemed most interesting theoretically, whereas the interpretation of correlates of general, undifferentiated factors such as the factor from our single-factor solution shown in Online Supplemental Table S5 may be less clear (see Southward et al., 2023; Watts et al., 2020 for discussion). However, we added description of correlations for factors from the one- and two-factor solutions after receiving feedback to ensure comprehensiveness in our presentation of findings.

As shown in Table 3, the General Factor from the single-factor model correlated most strongly (.71) with Psychoticism of any of the personality dimensions assessed via the PID-5, likely due to items assessing thought disorder loading strongly onto this general factor (all p values for all personality correlates < .001 given the large sample size). Regarding correlates for factors from the two-factor solution, notable associations included (a) Thought Disorder/Mania and PID-5 Psychoticism correlating .62 and (b) Internalizing and PID-5 Negative Affectivity correlating .64, with both of these strong correlations

being unsurprising based on content overlap across scales. Some associations for factors across the one- and two-factor solutions with specific medication ratings were statistically significant (e.g., with stimulant use; for Internalizing and antianxiety medication), though factor correlates with medication tended to be very weak in magnitude overall.

Next, factors from the three-factor solution showed distinct patterns of personality correlates in some ways, as shown in Table 4 (predictions for these correlations were preregistered as reviewed; see Online Supplemental Table S2 and https://rb.gy/9gp98). For example, Internalizing correlated strongly with PID-5 Negative Affectivity as anticipated ($r = .62$). Internalizing also correlated strongly with Detachment ($r = .53$), whereas correlations for the other two factors

Table 3. Correlations for the Factors from the One- and Two-Factor Solutions with Personality and Psychiatric Medication Use

Measure	One-Factor Solution	Two-Factor Solution	
	General Factor	Thought Disorder/Mania	Internalizing
Personality			
Psychoticism	**.71**	**.62**	**.54**
Negative Affectivity	**.53**	.30	**.64**
Disinhibition	**.50**	.41	.41
Detachment	.40	.20	**.52**
Antagonism	.47	.45	.30
Medication Use			
Stimulants	**.23***	**.18***	**.22***
Antipsychotics	**.17**	**.17**	.10
Mood Stabilizers	**.17**	.14	.14
Antianxiety	.12	.05	**.17***
Sleep Aids	.05	-.00	.10
Antidepressants	-.06	-.10	.03

Note. $N = 1,112$ for correlations with medication use and 419 for correlations with personality disorder traits. All correlations with self-report personality scores are Pearson correlations, and Pearson correlations $\geq .50$ are **bolded**. All factor correlations with personality ratings were significant at a $p < .001$ level. Correlations with categorical self-report medication use variables are polyserial correlations, and polyserial correlations $\geq |.15|$ are **bolded**. An asterisk (*) indicates that a polyserial correlation was significant at a $p < .001$ level.

with PID-Detachment were $\leq .21$[2]. Factors showed somewhat nonspecific associations in other cases, as all three factors had correlations in the range of .49 to .58 with PID-5 Psychoticism (rs = .53 for Thought Disorder, .49 for Internalizing, .58 for Agitation).

Correlations for factors from the three-factor model with medication use also are provided in Table 4, and these correlations were weaker in magnitude than we predicted in many cases. Still, some correlations were interesting and theoretically consistent, including (a)

Thought Disorder and antipsychotic use correlating .16 and (b) Internalizing correlating .17 with antianxiety use. Internalizing also correlated .19 with stimulant use. The correlations for the Internalizing factors across Tables 3 and 4 with stimulant use, although relatively weak, may have been driven by some item content assessing concentration difficulties loading strongly onto the Internalizing factors. The Agitation factor correlating .24 with stimulant use was another notable example, which was consistent in some ways with Agitation correlating robustly with PID-5 Disinhibition ($r = .44$)[3].

Discussion

Summary of Results and Their Value for Informing Dimensional Classification Models

Overall, our results provide support for classifying mania symptoms within the thought disorder spectrum at a broad level, consistent with recommendations from Kotov et al. (2020) that mania symptoms may align more closely with thought disorder than internalizing. Specifically, all IDAS-II Euphoria and Mania items loaded more strongly onto a joint factor with thought disorder ratings than on an Internalizing factor in our two-factor model. Some manic symptoms such as racing thoughts, racing to different activities, and increased energy loaded strongly onto an Agitation factor separate from other mania symptoms such as grandiosity and thought disorder in a three-factor solution. This differentiation of mania symptoms at a more specific level of abstraction would not have been possible to detect had we assessed mania at the composite level as done in most prior work.

Although a well-defined Agitation factor was identified in the three-factor solution separate from other thought disorder symptoms, our results still may suggest that symptoms (e.g., racing thoughts, increased activity) that loaded strongly onto Agitation may be optimally classified as a subspectrum within the broader thought disorder spectrum pending further investigation. Evidence supporting this interpretation

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[2] We also considered formally comparing the magnitude of correlations (e.g., using Fisher r-to-z transformations), but even relatively small differences in correlation magnitudes were statistically significant at a low p-value threshold in many cases due to the large sample size used.

[3] We also examined the extent to which our factor analytic results were similar when removing data from the subset of 113 participants who reported currently taking stimulant medication (10.2%). We conducted these analyses based on reviewer feedback identifying that it could be useful to consider the consistency of results when removing these participants' data given that some symptom ratings (e.g., feeling restless) included in our factor analyses overlap with ADHD, for which stimulant medication commonly is prescribed. Factor analytic results based on data from the 999 participants not taking current stimulant medication were highly similar to those from the overall sample of 1,112 participants. For example, a three-factor structure of Thought Disorder, Internalizing, and Agitation that very closely paralleled the three-factor structure from our overall sample was identified when analyzing data from this subset of 999 participants, as shown in Online Supplemental Table S8. Congruence coefficients were .99 for factor loadings for all factors shown in Online Supplemental Table S8 with their corresponding factors shown in Table 2 (e.g., when comparing factor loadings for the Agitation factors across Table 2 and Online Supplemental Table S8). These coefficients indicate very strong convergence across these sets of results (Lorenzo-Seva & ten Berge, 2006).

Table 4. Correlations for the Factors from the Three-Factor Solution with Other Study Variables

Measure	Thought Disorder	Internalizing	Agitation
Personality			
Psychoticism	**.53**	**.49**	**.58**
Negative Affectivity	.19	**.62**	**.41**
Detachment	.20	**.53**	.21
Antagonism	**.43**	.26	.35
Disinhibition	.32	.37	**.44**
Medication Use			
Antipsychotics	**.16**	.09	.12
Stimulants	.11	**.19***	**.24***
Antianxiety	.01	**.17***	.10
Mood Stabilizers	.12	.13	.14
Antidepressants	-.09	.04	-.07
Sleep Aids	-.07	.09	.08

Note. $N = 1,112$ for correlations with medication use and 419 for correlations with personality disorder traits. All correlations with self-report personality scores are Pearson correlations, and Pearson correlations $\geq .40$ are **bolded**. All factor correlations with personality ratings were significant at a $p < .001$ level. Correlations with categorical self-report medication use variables are polyserial correlations, and polyserial correlations $\geq |.15|$ are **bolded**. An asterisk (*) indicates that a polyserial correlation was significant at a $p < .001$ level.

includes (a) items that loaded strongly onto Agitation in the three-factor model loading strongly onto a joint factor with other manic and thought disorder symptoms in the two-factor model and (b) as a result, Agitation having a path coefficient of .80 with Thought Disorder/Mania from the two-factor model. Agitation also correlated most strongly with Psychoticism (.58) of any of the PID-5 trait scores. In summary then, symptoms such as racing thoughts, increased energy, and increased activity still appear closely intertwined with other mania symptoms, thought disorder symptoms, and personality traits aligning with thought disorder, even though they loaded onto a separate Agitation factor at more specific levels of analysis.

As discussed previously and in more detail subsequently, our assessment approach was not comprehensive, and these results most directly inform understanding of the classification of mania symptoms in relation to internalizing and thought disorder as a result. Still, these findings inform understanding of mania symptoms' alignment (or lack thereof) with the two spectra viewed as most strongly overlapping with mania based on traditional categorical and alternative dimensional models (Keyes et al., 2013), and they may help to guide future investigations examining mania's structure when using more comprehensive assessment approaches.

Additional Information Regarding Alignment with Study Predictions and Prior Literature

Our results were consistent with our predictions and the limited body of prior symptom-level research in some ways, though there were departures from both as well. The Thought Disorder factor in the three-factor model emerged largely as predicted, as items assessing both (a) positive psychotic symptoms and (b) select mania symptoms such as grandiosity loaded strongly onto this common factor. These findings also are consistent with other recent symptom-level studies indicating strong alignment for many manic symptoms with thought disorder (Forbes et al., 2021; Reininghaus et al., 2016), and our results also converge with prior work indicating that manic symptoms such as increased energy and euphoric mood clearly are separable from internalizing (e.g., Bedford & Deary, 2006; Stanton et al., 2019).

However, we did not predict that an Agitation factor would emerge in the three-factor model; instead, we hypothesized that items assessing euphoric mood and increased energy would load strongly onto a third Positive Activation factor. Instead of items assessing racing thoughts loading strongly onto Internalizing as we predicted, items assessing racing thoughts loaded weakly onto Internalizing and instead loaded strongly onto the Agitation factor along with items assessing increased energy. These findings also contrast with those from prior studies indicating that racing thoughts may be most characteristic of internalizing psychopathology (Forbes et al. 2021; Stanton et al., 2019; 2023; Wright et al., 2013). It is challenging to determine why exactly this may have been the case, as these prior studies also relied on large and/or clinically oriented samples as was done here. Differences may have been due in part to variation in assessment strategies. For example, Stanton et al. (2019) did not include indicators of thought disorder in their factor analyses; Wright et al. (2013) included only two mania ratings in their analyses; and Forbes et al. (2021) integrated a much broader range of psychopathology dimensions (e.g., obsessive-compulsive symptoms, substance use) than was done here.

Predicted external correlates were contingent upon the nature of emergent factors, which differed in some ways from our expectations as noted. One general theme was that factors tended to correlate less strongly with use of specific medications than expected. For instance, the Internalizing factor from both the two- and three-factor solutions correlated negligibly with antidepressant use. This may have been due in part to a large percentage of our sample taking antidepressants (41.2%), with one possible explanation being that participants were taking these medications to treat a broad range of symptoms rather than to treat symptoms

characteristic of a specific spectrum. Other correlations still were consistent theoretically even if weaker in magnitude than predicted. Examples of this included Thought Disorder factors correlating significantly with antipsychotic use, and Internalizing factors correlating significantly with anxiety medication use.

Factors across solutions also correlated significantly with stimulant use in some cases. This included the Agitation from the three-factor solution correlating .24 with stimulant use, and Agitation also correlated moderately with PID-5 Disinhibition (again, see Table 4). One possible interpretation could be that some Agitation items (e.g., restlessness) assess behaviors and patterns of cognition also characteristic of attention-deficit/hyperactivity disorder (ADHD), for which stimulant medication is often prescribed. Diagnosis of BSDs and ADHD often co-occur, and although ADHD symptoms are described as having more temporal stability than mania symptoms in the DSM (APA, 2022), clinicians sometimes have difficulty differentiating BSDs from ADHD (Skirrow et al., 2012). Future research examining the extent to which histories of specific mania symptoms are differentially linked to being prescribed specific medications would be useful (e.g., determining if stimulants are more likely to be prescribed if a history of mania symptoms such as distractibility and impulsivity are prominent; also see Waszczuk et al., 2017).

Limitations, Future Directions, and Conclusion

Our study advances the literature by taking a symptom-level approach to advance mania classification research, but we also would like to review several limitations and future directions in addition to those already discussed. First, it would have been helpful to include ratings of externalizing and other constructs such as ADHD that were not included here (Johnson et al., 2012; Skirrow et al., 2012). Next, even though we recruited a large sample of participants who self-identified as having significant mental health histories, endorsement levels still were relatively low for some symptoms (e.g., visual and auditory hallucinations). Therefore, examining results in other samples (e.g., inpatient samples) and when using other recruitment strategies would be useful. Determining the cross-sample consistency of structural results would be valuable for HiTOP-focused research more generally to inform dimensional classification and clinical assessment across samples varying in nature (Ruggero et al., 2019; also see Zimmerman, 2021 for discussion of concerns regarding the clinical implementation of dimensional models). Third, although retrospective report based on episodic memory has limitations for determining previous symptom nature and course

(Mestdagh & Dejonckheere, 2021), many individuals with a history of mania do not present with prominent manic symptoms when beginning treatment (Carta & Angst, 2016). Directly examining consistency in results when assessing symptoms currently versus retrospectively may be helpful as a result. Considering other method administration effects also could be useful as reviewed, including examining patterns of results when using interview and other informant methods.

Our study also shares limitations with many other existing studies conducted to inform dimensional classification, such as using a cross-sectional design that precluded longitudinal examination of symptom course. Determining the role longitudinal symptom course should play in classifying various symptoms within dimensional models has proven challenging (Olino et al., 2018), but doing so would be particularly informative in the case of mania symptoms because they are conceptualized as being episodic in nature. Longer-term examinations of symptom course across the lifespan are also needed given ongoing debate regarding BSD diagnosis in childhood and early adolescence (see Duffy et al., 2020 for review). We hope that future research will build from our findings by addressing these limitations to inform dimensionally-based classification and clinical assessment of mania symptoms.

Supplementary Materials

Supplemental tables and materials are available on the Open Science framework (please see the end of the manuscript file at this link): https://osf.io/7r6sg/

Additional Information

Conflict of Interest

The authors have no conflicts of interest (financial or otherwise) to report.

Ethical approval

This research received ethics board approval from the University of Wyoming Institutional Review Board (Protocol #20220727KS03365)

Data Availability

Deidentified study data and preregistered analytic predictions are available on the Open Science Framework:
https://osf.io/py95u/?view_only=b189bf45db094422b

Author CRediT Statement

KS developed the study idea, led data collection efforts, and led primary writing and analytic efforts. JM and JY contributed to literature reviewing and analytic planning. WM, LW, HO, and KB contributed to study planning and data collection efforts. All authors provided feedback on study analyses and contributed to manuscript writing efforts.

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