



Research report

A tale of two diatheses: Temperament, BIS, and BAS as risk factors for mood disorder

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ARTICLE INFO

Article history:

Received 23 March 2015

Accepted 26 March 2015

Available online 3 April 2015

Keywords:

Temperament

Behavioral inhibition

Behavioral activation

Mood disorder

Bipolar disorder

Diagnosis

ABSTRACT

Objective: Learning more about how biological traits, like temperament and sensitivity in the behavioral inhibition (BIS) and behavioral activation (BAS) systems, relate to mood pathology is consistent with the Research Domain Criteria initiative's goal of investigating mechanisms of risk.

Method: Korean young adults ($n=128$) and American young adults ($n=630$, of whom 23 has recent treatment for bipolar disorder, and 21 for depression) completed self-report questionnaires, including the TEMPS-A, the BIS/BAS scales, Beck Depression Inventory (BDI), and Hypomanic Checklist (HCL-32). Linear regression quantified relations between mood symptoms, sample characteristics, temperament, and BIS/BAS.

Results: Temperament styles explained 49% of the variance in BDI scores. BIS explained an additional 1% of the variance in BDI scores. BAS Fun and Reward ($p < .01$), in addition to cyclothymic and hyperthymic temperaments ($p < .001$) explained 21% of the variance in HCL-32 scores. Sample characteristics were not significant predictors in the full model.

Limitations: Differences in sample size, the cross-sectional study design, and lack of collateral report or behavioral measures of constructs are limitations.

Conclusions: Affective temperament and BIS/BAS are complementary but distinct constructs. Affective temperament, particularly cyclothymic, may represent a stronger diathesis for mood pathology, and seems potent irrespective of culture or diagnosis. Assessing temperament may help overcome some challenges in diagnosing mood disorders.

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1. Introduction

Mood disorders, including depression and bipolar disorder, impose significant cost to society and significant impairment to individuals (Judd and Akiskal, 2003; Simon, 2003; WHO, 2008), but the accurate diagnosis of mood disorders in young people can be difficult due to, among other reasons, the limited specificity of many symptoms, heterogeneous presentation, and comorbid diagnoses (Birmaher and Brent, 1998; Youngstrom, 2010; Youngstrom et al., 2008). Additionally, semantic differences in the way mood is described across people and cultures, and differences in the subjective experience of mood, can complicate the assessment of mood symptoms. Consequently, interest grows in biological traits that can be measured to infer risk for the development of a mood disorder. To the extent that biology represents a core factor,

focusing on measuring it may avoid some of the complexity involved in the cultural and personal construction of diagnoses.

The Research Domain Criteria (RDoC) represents one example of the shift toward an effort to understand mechanisms of psychopathology, rather than focusing solely on symptom-level phenomenology (Insel et al., 2010). Multiple pathophysiological systems are implicated in the manifest characteristics of mood disorders. A better understanding of how underlying mechanisms lead to symptoms will inform more precise diagnostic procedures and more effective intervention (Craske, 2012).

Rates of mood disorders, including bipolar spectrum disorders and depression, are higher in America than in Asian countries, whereas the rates of other disorders, like alcohol abuse, are higher in Asian countries (Chou et al., 2012; Merikangas et al., 2011). Complicating the picture is the fact that suicide, for which mood disorder is one of the primary risk factors, is more prevalent in Asian than American populations (Hee Ahn et al., 2012). Are apparent differences in mood disorder prevalence due to ethnocentric diagnostic criteria, differences in stigma or attitudes towards treatment seeking, differences in environmental risk, or genetic factors? Interestingly, some traits that

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are linked to bipolar disorder also vary between American and Asian cultures; for example, extroversion, dopamine expression, omega-3 fatty acid intake, temperament, and creativity (Chen et al., 1999; Church, 2010; Erez and Nouri, 2010; Muglia et al., 2002; Noaghiul and Hibbeln, 2003). Additionally, research has demonstrated that differences in culture and temperament may influence one another, creating the potential for unique risk to people with certain temperament styles within a given culture (Hofstede and McCrae, 2004). Therefore, temperament, and other risk factors that vary across culture, may provide a logical starting point for the investigation of cultural differences in mood-related risk factors.

Affective temperament styles (cyclothymic, hyperthymic, depressive, anxious, irritable) and sensitivity in the behavioral inhibition (BIS) and behavioral activation (BAS) systems are accumulating evidence as risk factors for the development of mood disorder (Akiskal, 1996; Akiskal and Akiskal, 1992; Alloy et al., 2008; Evans et al., 2005; Kochman et al., 2005; Meyer et al., 1999; Vázquez et al., 2008). Independent data suggest that these diatheses have predictive value. However, temperament has not been compared to BIS or BAS within a single sample to investigate whether there is overlap in the mood variance explained or if the three systems share a similar relation to mood. Also, the predictive value of these constructs across culture has not been assessed, although this could help to explain international differences in risk for mood disorder.

Dysregulation of BAS and BIS is thought to contribute to both the manic (high BAS, low BIS) symptoms associated with bipolar disorder and to the depressive (high BIS, low BAS) symptoms of major depression and bipolar disorder (Youngstrom and Izard, 2008). An individual's BAS regulates approach emotions, motivation, and positive mood states (Carver and White, 1994; Gable et al., 2000). Additionally, BAS correlates with mood fluctuations and corresponds with individuals' report of hypomanic symptoms (Meyer and Hofmann, 2005). When overactive, BAS may lead to a variety of psychopathology, including conduct disorder, antisocial personality disorder, and mania (Johnson et al., 2003; Quay, 1988). BAS deficits, on the other hand, are associated with low motivation, anhedonia, and depression (Kasch et al., 2002; McFarland et al., 2006).

BIS inhibits impulses to be active and to seek experiences that will elevate one's mood; it can lead to avoidance of other people and new experiences, and though adaptive when applied to risky situations, in excess, it is associated with depression and anxiety (Alloy et al., 2008; Johnson et al., 2003; Kasch et al., 2002; Meyer et al., 1999). Deficits in BIS can result in an absence of this natural "braking" system, leading to the lack of consideration for consequences and increases in dangerous and/or impulsive behaviors (Barkley, 1997). It follows that the same BIS dysregulation might result in the impulsivity seen in mania, but research investigating this hypothesis has not yet found support (Alloy et al., 2008; Meyer et al., 1999, 2001).

In addition to the phenomenological similarities between dysregulation of BIS and BAS and the mood states of depression and mania, there is also shared biology. The serotonergic system has been widely studied for its relation to mood (Kuzelova et al., 2010), and medications increasing the level of serotonin in the brain are the frontline treatment for depression (Davidson, 2010). Related, BIS is thought to be affected by serotonin; studies have found that depleting individuals' serotonin affects their behavioral inhibition (Crockett et al., 2009; Nomura et al., 2006) and the serotonin transporter polymorphism, 5-HTTLPR, has been linked to both BIS and mood disorders (Caspi et al., 2010; Whisman et al., 2011). BAS, on the other hand, has been linked to DRD2, a dopamine receptor, implicated in psychiatric disorders, like mania, in which approach or reward-seeking behaviors become dysregulated (Lee et al., 2007). Interestingly, different DRD2

polymorphisms have been linked to mood disorders in Asian and Caucasian populations (Zou et al., 2012).

Affective temperament is thought to be genetically-based (Evans et al., 2008; Gonda et al., 2006; Greenwood et al., 2012), and, importantly, the genes associated with affective temperament also increase one's risk for mood disorder, consistent with a shared diathesis. Specifically, the 5-HTTLPR serotonin transporter polymorphism – also associated with BIS (Whisman et al., 2011) – has been studied extensively in relation to both bipolar disorder and temperament (Cho et al., 2005; Yuan et al., 2012). Because temperament influences individual interactions with the world, it may sculpt later exposure to risk and/or protective factors (Izard, 2007; Rothbart et al., 2006). Importantly, the rates of affective temperament differ by culture, as do the rates of mood disorders, suggesting that the prevalence of mood pathology could be related to the prevalence of affective temperament (Gonda et al., 2011).

Both hyperthymic and cyclothymic temperament predict manic episodes, but interestingly, the association is stronger with cyclothymic temperament despite its more mixed mood content (Hantouche and Akiskal, 2006; Klein et al., 1986; Kochman et al., 2005; Oedegaard et al., 2009). In a large epidemiological study, cyclothymic temperament was a strong marker for bipolar disorder, with a specificity of 88% (Hantouche et al., 1998). Similarly, multiple prospective studies of people with depression have shown an association between cyclothymic temperament and conversion to bipolar disorder (Akiskal et al., 1995; Kochman et al., 2005). Given that 20–40% of youth with depression will go on to develop bipolar disorder, identifying risk factors for mania, like cyclothymic temperament or high BAS, among depressed youth is important (Alloy et al., 2008; Kochman et al., 2005).

The conceptualization of overactive BAS and BIS as predecessor to bipolar disorder or to depression, respectively, is compelling. However, the story of affective temperament is also persuasive, with trait anxiety, irritability and depression developing over time into depression, and the expansive and labile states of hyperthymic and cyclothymic temperaments blooming into mania. Given the shared elements of these two tales, and the seriousness of the ending at stake, it is important to find out whether each represents a unique risk.

The present study explores the relation between affective temperament and BIS and BAS, testing whether temperament, BIS, or BAS shows a stronger relation with mood symptoms. Participants were drawn from two samples, Korean young adults and American young adults (the American sample included a subset of cases identified as receiving treatment for bipolar disorder ($n=23$) or depression ($n=21$) based on a registry of clinical diagnoses), in order to better understand generalizability of associations between temperament, BIS, BAS, and mood symptoms across different cultures. Analyses concentrated on dimensional approaches to mood symptoms, consistent with evidence from statistical investigations of the phenomenology of depressive and manic symptoms (Peralta, 2007; Prisciandaro and Roberts, 2009), as well as with the conceptual framework of both personality research and the RDoC approach to investigating mechanisms.

For this purpose, a late adolescent-to-early adult-aged sample is particularly appropriate. This is the age of greatest risk for many forms of serious psychopathology, including depression and bipolar disorder (Berk et al., 2007; Kessler et al., 2005). Furthermore, life transitions – whether from family to college or out into the workforce – create stress that increases risk for mood episodes (Blanco et al., 2008). Risk for suicide and self-injury are high in this age group (Heath et al., 2008; Serras et al., 2010); given the relation between self-harm and mood disorder (Baldessarini et al., 2006; Furr et al., 2001; Garlow et al., 2008), it is important to improve risk assessment.

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