Assessment of personality dimensions in children and adolescents with bipolar disorder using the junior temperament and character inventory

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Assessment of Personality Dimensions in Children and Adolescents with Bipolar Disorder Using the Junior Temperament and Character Inventory


Abstract

Objective: We compared temperament and character traits in children and adolescents with bipolar disorder (BP) and healthy control (HC) subjects.

Method: Sixty nine subjects (38 BP and 31 HC), 8–17 years old, were assessed with the Kiddie Schedule for Affective Disorders and Schizophrenia–Present and Lifetime. Temperament and character traits were measured with parent and child versions of the Junior Temperament and Character Inventory.

Results: BP subjects scored higher on novelty seeking, harm avoidance, and fantasy subscales, and lower on reward dependence, persistence, self-directedness, and cooperativeness compared to HC (all \( p < 0.007 \)), by child and parent reports. These findings were consistent in both children and adolescents. Higher parent-rated novelty seeking, lower self-directedness, and lower cooperativeness were associated with co-morbid attention-deficit/hyperactivity disorder (ADHD). Lower parent-rated reward dependence was associated with co-morbid conduct disorder, and higher child-rated persistence was associated with co-morbid anxiety.

Conclusions: These findings support previous reports of differences in temperament in BP children and adolescents and may assist in a greater understating of BP children and adolescents beyond mood symptomatology.

Introduction

Bipolar disorder (BP) has received increased attention as a major mental health problem in children and adolescents (Biederman et al. 2000; Blader and Carlson 2007; Lyoo 2006). Despite this attention, there are few systematic attempts to examine personality dimensions associated with this disorder in children and adolescents (Chang 2003; Tillman et al. 2003). Substantial work has gone into describing symptom profiles of BP patients (Leibenluft et al. 2003; Geller and Tillman 2005). Exploring personality dimensions may provide a more comprehensive understanding of these patients and their needs. Cloninger’s psychobiological model proposes four dimensions of personality that are automatic, preconceptual responses to perceptual stimuli, presumably reflecting heritable biases (Cloninger 1987; Cloninger et al. 1993). In Cloninger’s model, temperament consists of these four dimensions: novelty seeking (NS), harm avoidance (HA), reward dependence (RD), and persistence (P). In addition, Cloninger’s model includes four factors of character: Self-directedness, cooperativeness, fantasy, and spirituality (Cloninger et al. 1993).

Initial studies with BP adults used the Tridimensional Personality Questionnaire (TPQ) (Bagby et al. 1992), a forerunner to the Temperament and Character Inventory (TCI) (Cloninger et al. 1994). Compared to national norms, adults with BP were significantly higher on the temperament dimensions of HA and RD (Osher et al. 1996). Strakowski et al.
(1992) used the TPQ to compare BP subjects to patients with other psychiatric disorders, and they found significantly elevated HA scores in depressed, mixed, and first-episode psychotic subjects (without an affective disorder) compared to manic subjects. An outpatient sample of euthymic BP patients had significantly higher TPQ scores on NS and HA scores versus healthy subjects (Young et al. 1995). This study also compared the euthymic BP subjects to recovered unipolar depressed subjects and found that the two groups did not differ on HA; however, NS scores were elevated in subjects with BP compared with unipolar patients (Young et al. 1995). In a sample of hospitalized adults, BP patients had significantly higher NS and RD compared to unipolar depressed patients whereas the unipolar subjects were higher on HA (Janowsky et al. 1999). However, BP subjects who were depressed were equivalent in HA compared to unipolar depressed subjects, but still scored higher on NS and RD (Janowsky et al. 1999).

In a study of patients with first-episode mania, higher TPQ-NS dimensional scores at the time of hospital discharge were associated with a failure to reach functional recovery at 6 months follow up (Strakowski et al. 1993). Studies using the TCI in adults with BP found they were significantly higher on the temperament dimensions of HA and RD in comparison to healthy control subjects (Engstrom et al. 2004). These findings were not replicated by Sayin et al. (2007) in a Turkish BP sample. This study found no difference in TCI temperament scores, but noted bipolar subjects had lower scores on the self-directedness and cooperativeness domains compared to healthy controls. Higher NS on the TCI was also seen in BP subjects with current substance abuse compared to BP subjects with remitted substance abuse and BP subjects without a history of substance abuse (Haró et al. 2007).

Three studies have reported personality dimensions in pediatric patients with BP disorder. In 23 adolescents with mood disorders, Brent et al. (1990) noted that Diagnostic and Statistical Manual of Mental Disorders, 3rd edition (DSM-III) (American Psychiatric Association 1980) cluster II, personality traits and diagnoses (Histrionic, Narcissistic, and Borderline) were associated with high NS scores on the TPQ, and these cluster II patients were more likely to have ADHD and BP diagnoses. Using the Junior Temperament and Character Inventory (JTCI) (Luby et al. 1999) to compare three groups of prepubertal children—BP subjects, ADHD subjects without BP, and a healthy control group—the prominent findings were higher NS, lower RD, and lower persistence in BP disorder type I compared to the healthy control group based on parent and child reports (Tillman et al. 2003). These BP subjects did not differ on most dimensions from ADHD subjects who did not have BP, except they had lower parental cooperative scores and a lower composite character score than the ADHD sample (Tillman et al. 2003). Chang et al. (2003) described offspring of BP subjects who had Axis I conditions such as attention-deficit/hyperactivity disorder (ADHD), anxiety disorders, BP, and depression, as having higher activity, more dysphoric moods, more rigidity, and lower persistence as measured by the Dimension of Temperament scale when compared to healthy BP offspring.

Our primary objective was to compare dimensions of temperament and character in children and adolescents with BP disorder and healthy control subjects. On the basis of existing literature, we expected BP subjects to have higher NS and HA and lower RD and persistence. A secondary objective was to compare personality dimensions within BP subjects with and without co-morbid conditions, namely ADHD, anxiety, and oppositional defiant disorder or conduct disorder (ODD/CD). On the basis of prior studies using the JTCI in children and adolescents with psychiatric disorders, we anticipated higher NS in subjects with ADHD (Tillman et al. 2003), higher HA in subjects with anxiety (Gothe1 et al. 2004), and lower RD in those with co-morbid ODD/CD (Rettew et al. 2004). Based on previous studies we expected to see higher NS, and lower persistence and self-directedness in the pediatric BP sample. We also expected to see a positive correlation between HA and depression scores. We explored the differences based on comorbidity as we expected the children with externalizing disorders (ADHD, ODD/CD) to score higher on NS while those with depression, mixed states or comorbid anxiety to show higher HA.

Methods

Subjects and assessments

Subjects were recruited from psychiatric outpatient clinics and media advertisement as part of a neuroimaging protocol. Subjects enrolled in the study were children and adolescents from 8 to 17 years old and in good physical health. All BP subjects were required to meet DSM-IV (American Psychiatric Association 1994) criteria for a diagnosis of BP type I, BP type II, or BP—not otherwise specified (NOS). Children and adolescents received the BP-I diagnosis if they met lifetime DSM-IV criteria for at least one episode of mania and BP-II if they met lifetime criteria for at least one episode of hypomania and one episode of major depression. Children and adolescents with clinically significant manic or hypomanic symptoms that did not fulfill the duration criteria for an episode as specified by the DSM-IV (i.e., 7 days or hospitalization for mania, 4 days for hypomania) received a BP-NOS diagnosis. We also used BP-NOS for children with irritability and at least four substantial manic symptoms that did not have clear cycles but a chronic course that was distinct from their pre-existing diagnoses, i.e., ODD or ADHD. Last, BP-NOS was used to classify subjects with significant elation and or grandiosity, but the total number of symptoms needed for a BP I or BP II diagnoses was inadequate. For our purposes, we defined significant mania or hypomania by the threshold criteria of the Kiddie Schedule for Affective Disorders and Schizophrenia–Present and Lifetime (K-SADS-PL) (Kaufman et al. 1997). This instrument requires these symptoms to be clearly out of proportion to circumstances, noticeable by others, and present daily, almost daily, or at least 50% of awake time. Patients with cyclothymia were included as BP-NOS because these subjects had recurrent hypomanic episodes and depressive symptoms, with a fluctuating course of at least a year in duration. The following Axis I, co-morbid diagnoses were allowed—anxiety disorders, ODD, CD, and ADHD. Healthy control subjects were required to have a negative family history of psychiatric disorders in first-degree relatives and no lifetime DSM-IV Axis I or II diagnosis. Exclusion criteria for both groups included neurological disorders, eating disorders, significant medical problems, pregnancy, presence of metal plates or parts in the body (exclusion factor for neuroimaging studies), and use of illegal substances within the last 6 months.
Separate interviews were conducted with the parents and subjects by the same M.D.- or Ph.D.-level clinicians. Psychiatric diagnoses were assessed using the K-SADS-PL (Kaufman et al. 1997). Prior to conducting K-SADS-PL interviews, M.D.- or Ph.D.-level clinicians showed 100% interrater agreement with a board-certified faculty child and adolescent psychiatrist (R.L.O.) for the diagnoses of BP type I, type II, and NOS on at least 5 cases. Final diagnoses were assigned via consensus of our diagnostic team after integrating the child and parent interview and other available clinical records. The consensus team was blind to other study measures, including the JTCI scores, at the time of diagnostic classification. All subjects underwent a physical examination, pregnancy and urine drug screening, and routine blood and urine laboratory tests to rule out medical problems, pregnancy, and use of illegal substances.

The JTCI was used to measure temperament and character traits. The JTCI is a modified version of the TCI (Cloninger et al. 1994) and consists of a 108-item, true or false, self-report questionnaire, with child and a parent versions. Luby et al. (1999) initially assessed the psychometric properties of the JTCI in a sample of 322 children and adolescents from a community sample between the ages of 9–13. This study reported good internal consistency with Cronbach z values ranging from 0.44 to 0.77, with only the spirituality subscale below 0.50. These authors reported a goodness of fit index (GFI) of 0.75 for the four-factor temperament model and 0.76 for the three-factor character scales using an orthogonal factor analyses (Luby et al. 1999). In a sample of adolescents (ages 12–18 years), in Germany, Schmeck et al. (2008) also reported Cronbach z values ranging from 0.48 to 0.81 on the JTCI, whereas Lyoo et al. (2004) examined Korean middle school students (age 13 ± 1 year), and reported Cronbach z values ranging form 0.48 to 0.80. Test–retest reliability in these samples ranged from 0.62 to 0.92, with most scores above 0.75 (Lyoo et al. 2004; Schmeck et al. 2008). Schmeck et al. (2008) reported GFI scores for both the four-factor temperament and three-factor character models as 0.99. In most studies, factors such as high novelty seeking, low reward dependence, and low cooperativeness were associated with poor school performance (Luby et al. 1999) and psychopathology (Copeland et al. 2004; Rettew et al. 2008; Schmeck et al. 2008). Although our sample allowed subjects between the ages of 8–17 years old, our mean age was 13.2 years with a standard deviation (SD) of 3 years, which is similar to the samples used in reliability studies (Luby et al. 1999; Lyoo et al. 2004; Schmeck et al. 2008). The four character factors (self-directedness, cooperativeness, fantasy, and spirituality) are derived from the TCI. The fantasy (subscale 1) and spirituality (combined subscales 2 and 3) scores are two subfactors from the TCI factor for “self-transcendence.” For all subjects, data were collected using both the child and parent versions of the JTCI. The child version is a self-report, and the parent version assesses their perception of their child.

This study was approved by the Institutional Review Board. Written informed consent was obtained from the parents or legal guardians and signed assent from all subjects.

Data analysis

Statistical analyses were performed using the SPSS software version 12.0.2 (SPSS, Inc., Chicago, IL). The overall association between diagnostic group and scores on the JTCI scales was evaluated using multivariate analysis of covariance (ANCOVA), with child’s age and gender as covariates. A significant multivariate test was followed by univariate ANCOVA with child’s age and sex as covariates and statistical significance at the p < 0.003 level after correction for multiple comparisons for the eight JTCI dimensions using parent and child scales (p = 0.05/16). A separate analysis was performed on each scale for parent and child reports. The agreement between parent and child reports of the JTCI was estimated by calculating the intraclass correlation coefficient between the parent and child scores on each JTCI scale using a model that assumed subject as a random factor and parent versus child as a fixed factor. The intraclass correlation coefficients were estimated for a single rater, i.e., parent and child scores were not averaged and absolute agreement was used as the reliability standard.

Exploratory analyses based on co-morbid conditions, BP subtypes, and demographic characteristics used a statistical significance at the p < 0.05 level. We found significant overlap between our anxiety subjects, i.e., 70% of our subjects with generalized anxiety disorder (GAD) also met criteria for separation anxiety disorder (SAD); therefore, we combined these groups. On our exploratory analyses, there were no differences between our CD and ODD subjects on any JTCI measures (data not shown); therefore, we combined these into a CD/ODD group. Our controls subjects endorsed negligible symptoms on the Young Mania Rating Scale (YMRS) and Hamilton Scale of Depression (HAM-D); therefore, we explored a correlation between these scales and JTCI scores only for our BP subjects. Because our subjects ranged from ages 8 to 17, we examined potential correlations between JTCI variables and age.

Results

Clinical and demographic characteristics

Sixty-nine children and adolescents (38 BP and 31 healthy control subjects) completed the JTCI. Analyses of clinical variables among subjects in the BP group demonstrated that 84% percent (n = 32) of the subjects met criteria for a co-morbid condition. Subjects in the BP and healthy control groups were similar in age and gender (Table 1).

Child-reported data

A multivariate analysis demonstrated a highly significant effect of diagnostic group on the combined JTCI scales for child-reported data (Wilks lambda = 0.44, F = 9.13, df = 8, 58, p < 0.001). We found significant differences between BP and healthy children and adolescents with BP scoring higher on NS (F = 17.24, df = 1, 65, p < 0.001) and HA (F = 20.55, df = 1, 65, p < 0.001), and lower on RD (F = 15.54, df = 1, 65, p < 0.001), and a near-significant effect for lower persistence (F = 8.23, df = 1, 65, p = 0.006). On character factors, the BP subjects scored significantly lower on self-directedness (F = 34.72, df = 1, 65, p < 0.001), and cooperativeness (F = 31.63, df = 1, 65, p < 0.001) subscales and significantly higher on the fantasy subscale (F = 14.33, df = 1, 65, p < 0.001) compared to healthy control subjects (Table 2). BP subjects did not differ significantly on the spirituality subscale (F = 0.32, df = 1, 65, p > 0.5) compared to healthy control subjects. Control subjects had...
a significant inverse correlation between HA and age 
\((r = -0.719, p = 0.002)\) and a positive correlation with SD and age 
\((r = 0.663, p = 0.01)\). Our BP subjects displayed a significant positive correlation with NS and age 
\((r = 0.651, p = 0.004)\) and a trend for an inverse correlation between persistence and age 
\((r = -0.565, p = 0.05)\) (Table 3).

**Parent-reported data**

Consistent with the child report data, parent reports yielded a significant multivariate effect of diagnostic group on the combined JTCI (Wilks lambda = 0.27, \(F = 20.0, \ df = 8, 58, p < 0.001\)). Parents of BP children and adolescents rated their offspring higher on NS (\(F = 35.6, \ df = 1, 65, p < 0.001\)) and HA (\(F = 35.8, \ df = 1, 65, p < 0.001\)), and lower on RD (\(F = 31.1, \ df = 1, 65, p < 0.001\)), and persistence (\(F = 14.6, \ df = 1, 65, p < 0.001\)) compared to parents of control children. The BP parents also rated their offspring lower on self-directedness (\(F = 89.9, \ df = 1, 65, p < 0.001\)) and cooperativeness (\(F = 67.3, \ df = 1, 65, p < 0.001\)) but higher on the fantasy scale (\(F = 26.8, \ df = 1, 65, p < 0.001\)), compared to parents of healthy controls. No significant differences between the two groups were found for the spirituality subscales (\(F = 0.6, \ df = 1, 65, p < 0.464\)) (Table 4). There were no significant correlations between JTCI variables and age on parent report (see Table 5).

**Parent–child concordance on the JTCI scales**

The intraclass correlation coefficient for parent–child concordance on the temperament dimensions ranged from 0.3 to 0.4, and on the character dimensions ranged from 0.1 to 0.5, which are considered as “poor” to “fair” (Cicchetti et al. 2006). Therefore, we explored the parent and child reporting further using paired \(t\)-tests with healthy controls and BP subjects, respectively. We found healthy control children differed significantly \((p < 0.05)\) from their parents because they rated themselves as less reward dependent, more persistent, more cooperative, and higher on spirituality. Similarly, BP children

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**Table 1. Demographic and Clinical Characteristics of Bipolar and Healthy Subjects**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Bipolar (n = 38)</th>
<th>Healthy (n = 31)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>24</td>
<td>63.2</td>
</tr>
<tr>
<td>Female</td>
<td>14</td>
<td>36.8</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>24</td>
<td>63.2</td>
</tr>
<tr>
<td>Hispanic</td>
<td>12</td>
<td>31.6</td>
</tr>
<tr>
<td>Afro-American</td>
<td>2</td>
<td>5.3</td>
</tr>
<tr>
<td>Family history of psychiatric disorders (yes)(^a)</td>
<td>33</td>
<td>86.8</td>
</tr>
<tr>
<td>Family history of mood disorders (yes)(^a)</td>
<td>31</td>
<td>81.6</td>
</tr>
<tr>
<td>Bipolar Disorder type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>19</td>
<td>50.0</td>
</tr>
<tr>
<td>II</td>
<td>13</td>
<td>34.2</td>
</tr>
<tr>
<td>NOS</td>
<td>6</td>
<td>15.8</td>
</tr>
<tr>
<td>Psychiatric medication (yes)(^c)</td>
<td>23</td>
<td>60.5</td>
</tr>
<tr>
<td>Comorbidities (Lifetime)(^d)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Separation Anxiety Disorder</td>
<td>16</td>
<td>42.1</td>
</tr>
<tr>
<td>Generalized Anxiety Disorder</td>
<td>17</td>
<td>44.7</td>
</tr>
<tr>
<td>Other Anxiety</td>
<td>9</td>
<td>23.6</td>
</tr>
<tr>
<td>Any Anxiety</td>
<td>21</td>
<td>55.2</td>
</tr>
<tr>
<td>ODD</td>
<td>9</td>
<td>23.6</td>
</tr>
<tr>
<td>Conduct Disorder</td>
<td>14</td>
<td>36.8</td>
</tr>
<tr>
<td>Conduct Disorder/ODD</td>
<td>23</td>
<td>60.0</td>
</tr>
<tr>
<td>Attention - Deficit/Hyperactivity Disorder</td>
<td>26</td>
<td>68.4</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SD</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (y)</td>
<td>13.3</td>
<td>3.0</td>
</tr>
<tr>
<td>Years of schooling</td>
<td>7.3</td>
<td>3.1</td>
</tr>
<tr>
<td>GAF</td>
<td>47.9</td>
<td>10.7</td>
</tr>
<tr>
<td>YMRS</td>
<td>10.92</td>
<td>8.02</td>
</tr>
<tr>
<td>HAM-D</td>
<td>11.97</td>
<td>7.01</td>
</tr>
<tr>
<td>Age of onset of Bipolar Disorder (y)</td>
<td>8.5</td>
<td>3.4</td>
</tr>
<tr>
<td>Length of illness (mo)</td>
<td>55.8</td>
<td>33.1</td>
</tr>
</tbody>
</table>

**Abbreviations:** NOS = Not Otherwise Specified, SD = Standard Deviation, GAF = Global Assessment of Function, ODD = Oppositional Defiant Disorder; YMRS = Young Mania Rating Scale; HAM-D = Hamilton Scale of Depression.

\(^a\)Includes first, second and third degree relatives.

\(^b\)Excludes first-degree relatives, because family history in first-degree relatives was an exclusion criterion for healthy controls.

\(^c\)Includes antidepressants, antipsychotics, mood stabilizers and stimulants.

\(^d\)Percentage based on total number of lifetime diagnoses. Categories are not mutually exclusive.
differed significantly (p < 0.05) from their parent’s ratings because they rated themselves as less novelty seeking, more persistent, more self-directed, more cooperative, and higher on spirituality (see Tables 2 and 4).

Clinical characteristics

The control group was essentially asymptomatic; therefore, we chose only to examine clinical associations within the BP group. Within the BP group, we did not find significant correlations between either the child or parental JTCI scales and either the YMRS or the HAM-D scores. Parental data revealed

Table 2. Child-Reported Temperament and Character Scores on the JTCI for DSM-IV Bipolar Disorder and to Healthy Controls

<table>
<thead>
<tr>
<th>Healthy controls (n = 31)</th>
<th>Bipolar disorder (n = 38)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean SD</td>
<td>Mean SD F p* d*</td>
</tr>
<tr>
<td>NS  6.61 (3.62)</td>
<td>10.55 (3.78) 17.24 0.000 1.06</td>
</tr>
<tr>
<td>HA  6.00 (3.87)</td>
<td>10.29 (5.61) 20.55 0.000 0.91</td>
</tr>
<tr>
<td>RD  5.55 (1.75)</td>
<td>3.71 (1.99) 15.54 0.006 0.98</td>
</tr>
<tr>
<td>P  3.90 (1.35)</td>
<td>2.74 (1.77) 08.23 0.001 0.74</td>
</tr>
<tr>
<td>SD 16.94 (2.79)</td>
<td>12.40 (4.02) 34.72 0.000 1.33</td>
</tr>
<tr>
<td>C  16.90 (2.34)</td>
<td>12.63 (3.58) 31.63 0.000 1.44</td>
</tr>
<tr>
<td>ST1 0.94 (1.21)</td>
<td>2.26 (1.54) 14.33 0.000 0.96</td>
</tr>
<tr>
<td>ST2-3 3.39 (1.41)</td>
<td>3.18 (1.52) 00.32 0.555 0.14</td>
</tr>
</tbody>
</table>

Table 4. Summary of Differences Between Bipolar subjects with Comorbid Conditions

<table>
<thead>
<tr>
<th>BP + ADHD</th>
<th>BP-non ADHD</th>
</tr>
</thead>
<tbody>
<tr>
<td>n = 26 mean (SD)</td>
<td>n = 12 mean (SD) p* d*</td>
</tr>
<tr>
<td>Parent NS 13.73 (3.66)</td>
<td>9.75 (3.89) 0.007 1.05</td>
</tr>
<tr>
<td>Parent SD 7.54 (4.02)</td>
<td>9.75 (4.55) 0.04 0.52</td>
</tr>
<tr>
<td>Parent C 8.62 (5.37)</td>
<td>13.25 (3.52) 0.003 1.04</td>
</tr>
<tr>
<td>BP + CD/ODD</td>
<td>BP-non-CD/ODD</td>
</tr>
<tr>
<td>n = 23 mean (SD)</td>
<td>n = 15 mean (SD)</td>
</tr>
<tr>
<td>Parent RD 3.39 (2.23)</td>
<td>5.46 (2.30) 0.01 0.91</td>
</tr>
<tr>
<td>Child P 3.38 (1.88)</td>
<td>1.94 (1.25) 0.008 0.92</td>
</tr>
</tbody>
</table>

Abbreviations: JTCI = Junior Temperament and Character Inventory, SD = Standard Deviation, DSM-IV = Diagnostic and Statistical Manual of Mental Disorders, fourth edition, NS = Novelty Seeking, HA = Harm Avoidance, RD = Reward Dependence, P = Persistence, SD = Self-Directedness, C = Cooperativeness, ST1 = Self-Transcendence 1(fantasy), ST2-3 = Self-Transcendence 2-3 (spirituality).

*statistical significance at the p < 0.05 uncorrected for multiple comparisons.
†Cohen’s d is a measure of effect size.

BP subjects with co-morbid ADHD (n = 26) had higher NS scores (F = 8.5, df = 1, 24, p = 0.007), lower self-directedness (F = 4.2, df = 1, 34, p = 0.048), and lower cooperativeness (F = 6.4, df = 1, 34, p = 0.003) scores in comparison to BP subjects without ADHD (n = 12). BP subjects with co-morbid CD or ODD (n = 23) scored lower on reward dependence (F = 5.1, df = 1, 34, p = 0.01) compared to those without these co-morbid conditions (n = 15). Child-reported findings also demonstrated: BP subjects with a co-morbid anxiety disorder (n = 21) scored higher on persistence (F = 6.8, df = 1, 34, p = 0.008) than subjects without anxiety disorder (n = 17) but did not differ on other scales. These findings are summarized on Table 4. Removing the BP-NOS subjects (n = 6) from our analyses did not alter our original findings. We did not find a significant difference between BP I (n = 19) and BP II (n = 13) on any dimension.

Our sample included patients ranging from ages 8 to 17 years. Therefore, we divided our sample into adolescents age ≥13 years (BP n = 22, mean age = 15.5, SD = 1.3 years, and healthy controls n = 16, mean age = 15.6, SD = 1.5 years) and children age <13 years (BP n = 16, mean age = 10.2, SD = 1.3 and healthy controls n = 15, mean age = 10.3, SD = 1.8). We found the same JTCI domain differences between BP subjects and controls on both parent and child report in these age groups as noted in the combined sample (data not shown).

Discussion

We found children and adolescents with BP had higher NS and HA and lower RD and persistence temperament scores compared to healthy controls. Differences on domain scores can be considered individually or combinations of temperament traits can be used to classify abnormal personality variants (Cloninger 1987). Using the TPQ, subjects with the combination of high NS, high HA, and low RD were described as having an “explosive personality” where they would exhibit difficulties inhibiting outbursts of rage while feeling socially alienated (Cloninger 1987). In children and adolescents, the traits of irritability and aggression are now recognized as major clinical features of pediatric BP
Table 5: Pearson Correlations Between JTCI Variables and Age

<table>
<thead>
<tr>
<th>Child response control</th>
<th>BP response control</th>
<th>Parent response control</th>
<th>BP</th>
<th>age</th>
<th>age</th>
<th>age</th>
<th>age</th>
</tr>
</thead>
<tbody>
<tr>
<td>NS</td>
<td>0.357</td>
<td>0.651*</td>
<td>0.357</td>
<td>0.071</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HA</td>
<td>-0.719*</td>
<td>-0.068</td>
<td>-0.017</td>
<td>0.247</td>
<td></td>
<td></td>
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<tr>
<td>RD</td>
<td>0.269</td>
<td>0.030</td>
<td>0.347</td>
<td>0.192</td>
<td></td>
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<tr>
<td>P</td>
<td>0.314</td>
<td>-0.565</td>
<td>-0.001</td>
<td>0.227</td>
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<tr>
<td>SD</td>
<td>0.663*</td>
<td>-0.125</td>
<td>0.141</td>
<td>0.183</td>
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<tr>
<td>ST1_C</td>
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<td>0.036</td>
<td>-0.354</td>
<td>0.024</td>
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<tr>
<td>ST2-3_C</td>
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<td>0.021</td>
<td>0.225</td>
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<tr>
<td>ST2-3_P</td>
<td>-0.176</td>
<td>-0.207</td>
<td>-0.104</td>
<td>0.188</td>
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Abbreviations: NS = Novelty Seeking, HA = Harm Avoidance, RD = Reward Dependence, P = Persistence, SD = Self-Directedness, C = Cooperativeness, ST1 = Self-Transcendence 1 (fantasy), ST2-3 = Self-Transcendence 2-3 (spirituality), JTCI = Junior Temperament and Character Inventory.

*statistical significance at the p < 0.05 uncorrected for multiple comparisons.

We found many of the same differences between BP subjects and controls as the only other published study using the JTCI in BP children and adolescents (Tillman et al., 2003), with the exception of increased HA in our sample. A possible explanation for the discrepancy in our studies is that our subjects were on average older than Tillman et al.’s (2003) sample (13.3 ± 3.0 vs. 10.8 ± 2.6 years old, respectively). Our study is consistent with studies of adults with BD who also reported high HA relative to control groups (Young et al. 1995; Osher et al. 1996; Engstrom et al. 2004). In a healthy sample (ages 9–13), a significant inverse correlation for age and HA was found, as was a significant positive correlation between age and NS (Luby et al. 1999). These authors suggest that these findings reflect normal development as children approach adolescence and the expected pursuit of independence (Luby et al. 1999). Similarly, our healthy controls subjects had a significant inverse correlation for age and HA, a significant positive correlation between age and SD, and positive correlation between age and NS that did not reach significance.

Our BP subjects did have a positive correlation between age and NS; however, they did not show the inverse correlation for age and HA seen in healthy samples. The finding of both high NS and HA in our BP sample and in adult BD subjects suggests that significant harm avoidance persists in these patients. Papalos et al. (2007) similarly described a large sample of children and adolescents with BD as being elevated on a “fear of harm” dimension that included characteristics of fearfulness, irritability, and aggression. Although anxiety symptoms are not part of the DSM-IV criteria for BP, these symptoms are increasingly recognized as part of the pediatric BP phenotype (Masi et al. 2001; Dickstein. 2005).

Our finding of high NS is complicated by the high level of psychiatric co-morbidity often seen in BP cohorts, in particular ADHD (Biederman et al. 1987; Biederman et al. 1996; Chang et al. 2000; Geller et al. 2000; Findling et al. 2001). People with “severely high” NS (Cloninger 1987) are described as thrill seeking, impulsive, and intolerant of monotony, but these traits are not specific to BP disorder. Schmeck and Poustka (2001) reported a pattern of high NS in patients with CD (with and without ADHD), with a significant inverse correlation between NS and HA in these children. Copeland et al. (2004) found a significant positive correlation between NS and CBCL scores of attention and externalizing problems. In the Tillman et al. (2003) study, subjects with BP and subjects with ADHD both differed from controls on NS and did not differ from each other on this dimension. Our finding of higher NS in co-morbid BP ADHD subjects compared to non-ADHD BP subjects on NS may reflect the co-occurring ADHD. As in other studies (Osher et al. 1996; Chang 2003; Tillman et al. 2003), we noted lower persistence in BP subjects compared to controls. Persistence is related to perseverance (resistance to extinction), which may also arise from the co-morbid ADHD.

High NS is the most consistent finding in CD (Schmeck and Poustka 2001) and disruptive behavior disorders (CD or OD) samples (Rettew et al. 2004; Schmeck and Poustka 2001). We did not find higher NS in the BP ODD/CD patients compared to the BP patients without ODD or CD; however, this might also be attributable to the high prevalence of ADHD throughout the sample. We did note the BP ODD/CD patients were significantly lower on RD compared to the BP patients without ODD/CD. Low RD children are described as being insensitive and socially detached (Cloninger 1987), which might reflect some early antisocial tendencies as well as anhedonia in this BP subset. Rettew et al. (2004) also described lower RD in children with disruptive behavior disorders (ADHD/ODD/CD) with or without internalizing disorders in comparison to healthy control subjects. Therefore, if high NS and low RD are shared by other externalizing disorders, our data suggest these personality dimensions in combination with HA might be unique to BP, but further research is warranted.

The three dimensions of character (self-directedness, cooperativeness, and self-transcendence) represent self-concepts and individual differences in goals and values, which develop throughout life (Cloninger et al. 1993; Bayon et al. 1996). Our BP subjects scored lower on self-directedness and cooperativeness but higher on the fantasy scale. Self-directedness measures the ability to regulate and adapt behavior to given situations, whereas cooperativeness measures social tolerance and willingness to be helpful. Lower scores on these dimensions may capture symptoms often seen in ODD, which was common in our sample. In the Tillman et al. (Tillman et al. 2003) study, BP subjects differed from both ADHD subjects and normal controls on cooperativeness only on the parent-rated scale. Copeland et al. (2004) reported a significant negative correlation with CBCL scores of attention and externalizing problems and RD, persistence, self-directedness, and cooperativeness.

A limitation with cross-sectional studies is that we cannot determine to what extent differences in temperament ratings are due to personality or secondary to the current illness. Longitudinal studies using direct observation of young children find that early temperament can be predictive of later diagnoses. In general, behavioral inhibition is associated with later anxiety symptoms, whereas behavioral disinhibition predicts disruptive behavior disorders (Hirshfeld-Becker et al. 2003). Further inspection of these studies (Hirshfeld-Becker et al. 2003) reveals that, although these constructs predict el-
evated risk for disorders, they are nonspecific and the positive predictive value for a diagnosable disorder is in the range of 20–30%. A latent profile analyses of the JTCI in children and adolescents drawn from clinical and community samples found a “disengaged group” that had high NS, low RD, and was predictive but not specific for childhood pathology (Rettew et al. 2008).

Disentangling the differences between temperament and psychopathology is not only an important research question but may have practical implications (Carey 1998; Stein et al. 2001). Recent studies suggest that family-based interventions can be effective adjuncts to medication in the management of BD in children and adolescents (Fristad 1998; Fristad et al. 2003; Miklowitz et al. 2004; Pavuluri et al. 2004; West et al. 2007). Although these treatments vary, common themes include psycho-education, parenting techniques, problem solving, communications skills, management of affect, and ways of engaging support systems outside of the home. There is evidence that temperament interacts with parenting practices, because children with a difficult temperament have worse externalizing symptoms in response to negative discipline and have fewer externalizing symptoms and aggression in response to positive parenting (van Zeijl et al. 2007). In depressed subjects, those with high harm avoidance and low self-directedness have a poor response to interpersonal therapy, whereas subjects with low persistence did poorly in response to cognitive behavioral therapy (Joyce et al. 2007). Considering a patient’s temperament may assist in implementing a patient tailored treatment beyond just mood stabilization.

**Limitations**

This study shows that BP subjects have different temperament and character traits than healthy control subjects; but future studies are necessary to clarify if these differences in personality dimensions result from the illness itself or if such differences predispose to the development of pediatric BP disorder. In addition to the cross-sectional nature of our study, our study excluded BP subjects with recent substance abuse problems, which limits the ability to apply these findings to many BP patients. Another limitation of this study is that our comparison group lacked any family history of psychiatric disorders, which potentially inflated the magnitude of the differences seen. However, comparing clinical groups can also raise confounding factors, as was highlighted in the Tillman et al. study (2003), where few differences were seen between the BP subjects and the ADHD group. However, 88% of their BP sample also had ADHD and 18% of their ADHD sample went on to have either mania or hypomania. Similar confounds would arise when comparing other clinical groups, i.e., children with anxiety, depression, and disruptive disorders, with BP subjects because all of these disorders are common in BP samples. In addition, using controls with family histories for psychiatric conditions is a challenge because these children and adolescents may have not passed through the critical period for the expression of BP. Disentangling the effects of BP from co-morbid conditions is an ongoing challenge to the field, requiring larger, longitudinal studies with sufficient power to do so. Last, our intraclass correlations were low. There is a controversy whether the information provided by children can be valid or reliable; however, it seems that the quality of the information obtained from children may depend on the type of information being asked. Luby et al. (1999) found children are more able to report objective experiences and emotions rather than their personal characteristics and behavior. Jensen et al. (1999) demonstrated that both parent and child reports are necessary to acquire adequate diagnostic information. It appears that children and adolescents (both healthy and BP) generally endorsed items in a manner to appear healthier than their parents did. Overall analysis of the JTCI scales by the reports of children and parents resulted in very similar findings.

Future research on temperament would benefit from longitudinal designs as well as studies that further examine the effects of treatment and mood state. Progress in the fields of imaging and genetics will provide future options for studying temperament in both health and psychiatric samples. Examples for future research include functional magnetic resonance imaging (MRI) paradigms that examine fear, emotional regulation, and reward or impulsivity characteristics. Possible genetic polymorphisms of interest include those involved with catecholamines (i.e., the promoter region of the serotonin transporter or the dopamine transporter) and the hypothalamic pituitary axis (i.e., corticotropin-releasing hormone receptor), just to name a few.

**Disclosures**

Dr. Rene Olvera is on the speakers bureaus of AstraZeneca Pharmaceuticals, McNeil Pharmaceuticals, and Janssen Pharmaceuticals, and is a consultant for McNeil Pharmaceuticals and Shire Pharmaceuticals. Dr. Steven R. Pliszka receives research support from Eli Lilly Pharmaceuticals and AstraZeneca Pharmaceuticals, is on the speakers bureau of McNeil Pharmaceuticals, and is a consultant for McNeil Pharmaceuticals and Shire Pharmaceuticals. Drs. Fonseca, Caetano, Hatch, Cloninger and Soares, Ms. Hunter, and Mr. Nicoletti have no conflicts or financial ties to disclose.

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