

Theory of Mind in Adolescents with Bipolar Disorder in Euthymic Phase: Using the Strange Stories Test

Hamid Zarrabipoor, MSc¹
 Mehdi Tehrani-Doost, MD^{1,2}
 Zahra Shahrivar, MD^{1,2}

1. Department of Psychiatry, Tehran University of Medical Sciences, Roozbeh Hospital, Tehran, Iran.

2. Research Center for Cognitive and Behavioral Sciences, Tehran University of Medical Sciences, Tehran, Iran

Corresponding author:

Mehdi Tehrani-Doost, MD
 Professor of Child and Adolescent Psychiatry, Department of Psychiatry, Tehran University of Medical Sciences, Roozbeh Hospital, Tehran, Iran.
 Tel: 021 55412222
 Fax: 021 55419113
 Email: tehranid@sina.tums.ac.ir

Objective: This study evaluated the theory of mind (ToM) in adolescents diagnosed with bipolar disorder (BD) during their euthymic period compared to a typically developing (TD) group.

Method: The BD group consisted of thirty 11-18 year old inpatients in euthymic phase. The TD group included 30 age, gender, and IQ matched volunteer students. To assess the diagnosis and comorbid disorders, we performed the semi-structured interview of the Kiddie Schedule for Affective Disorders and Schizophrenia-Present and Lifetime Version (K-SADS-PL) for the BD adolescents. To evaluate the severity of attention deficit hyperactivity disorder (ADHD) and mania, Conner's Parent Rating Scale-Revised version (CPRS-R), and Young Mania Rating Scale (YMRS) were used, respectively. Ravens Progressive Matrices was conducted to evaluate intellectual ability in the both groups. Happe Strange Stories test was performed to assess ToM in the participants. Data were analyzed using the independent t-test, analysis of covariance, and Pearson Correlation analysis.

Results: The two groups did not show any differences in comprehending the stories; however, the BD group's mentalizing scores were significantly weaker than the TD group ($p < 0.05$).

Conclusion: The ToM impairments in adolescents with BD may be explained as a trait marker which may lead to continuation of social problems even during remission.

Key words: *Adolescents, Bipolar Disorder, Social Cognition, Theory of Mind*

Iran J Psychiatry 2016; 11:3: 133-139

Bipolar disorder (BD) has been described with periods of mania, depression and remission. The lifetime prevalence of BD type I has been reported to be 1% in adolescents (1, 2). However, adolescents with BD type II form 10% of the society and this disorder mostly occur between the ages of 14 and 18 years (3).

Evidence shows that 20-50% of the patients with BD have chronic social impairment (4) and difficulty in interaction with others (5) as well as a reduction in social relationships and dissatisfaction in family and social interactions (6). Deficits in social relationships in these patients continue even during the period of remission (4); however, the existing findings are inconsistent (7).

To understand the underlying mechanisms of social functioning, social cognition has been explored as an advanced mental process essential to understand other's intentions and attitudes (8). Social cognition includes subcategories such as relationship dynamics, social knowledge and perception (9).

Research on social cognition has recently focused on theory of mind (ToM). ToM is a term used to describe such mental states conceptualizations as beliefs, desires, intentions and emotions (10). ToM also refers to a process through which people predict and interpret

others' behaviors (11). ToM related deficits in social interactions have been examined repeatedly in autism and schizophrenia spectrum disorders (12), and recently in individuals with BD (13). Kerr et al. (2003) (14) compared the ability of ToM between BD adult individuals in normal, depressive, and manic phases, and a healthy group. First and second false-belief tasks showed that ToM was impaired in the periods of depression and mania, but was intact in euthymic phase. Montag et al. (2010) (15) and Olley et al. (2005) (16) did not find any ToM impairment in the period of normal mood. However, Bora (2005) (17) showed that ToM was weak in people whose mood disorder had been treated. Wolf (2010) (18) found that ToM was more impaired in all BD phases compared to the healthy group. A recent meta-analysis (19) confirmed a significant modest ToM dysfunction in subclinical and remitted BD, and a higher ToM dysfunction in acute episodes. These deficits may have an important role in interpersonal problems seen in individuals with BD. Moreover, some studies have found social dysfunction in pediatric BD (20, 21 and 22). Besides, study of offspring of parents with BD found social impairment in these youths (23). Whitney et al. (2014) (24) suggested that children and adolescents may show social impairment before they experience the onset of

mania, a fact consistent with common chronic prodromal period before the emergence of pediatric BD (25). Schenkel et al. (2008) (26) conducted the first study on ToM in pediatric BD and found that ToM functions of the adolescents with BD during the periods of depression and mania were weaker than the healthy group. Moreover, Schenkel et al. (2014) (27) showed that poor interpersonal functioning in pediatric BD type I was associated with ToM deficits. They did not find any significant differences between pediatric BD type II and healthy group in terms of mentalizing ability.

The ToM literature on euthymic phase of BD in adolescents is still scant and inconsistent. Moreover, most studies have used parents reports or / and first or second order false belief tasks to test ToM abilities (first order means to infer someone's mental state; second order means to infer someone mentalizing about another person's mental state). However, advanced instruments are available to evaluate higher levels of mentalizing process. For example, the strange stories test assesses individuals' understanding of pretending, double bluffing, lying, persuading, etc. In addition, the studies on ToM in Iranian children and adolescents with BD are limited. These facts encouraged us to study the underlying mechanisms of impairment in the social relationships of adolescents with BD when they are in euthymic phase. We hypothesized that the ability of the adolescents with BD in understanding others' higher mental states when they are in the remission phase is lower than the healthy group.

Materials and Method

Participants

The study population consisted of 11-18 year old adolescents with BD ($n = 30$) and their normal developing counterparts ($n = 30$). The clinical group was recruited from inpatients in the child and adolescent ward at Roozbeh hospital. The typically developing individuals were volunteers from mainstream schools. Exclusion criteria for both groups included any neurological or developmental disorder, any history of head trauma, alcohol consumption, any physical illness influencing cognitive functioning, and IQ lower than 90.

After explaining the study and obtaining informed consent from the participants (written permission from parents and verbal permission from adolescents), we included those adolescents who had been diagnosed with BD in acute, manic or mixed period by a child and adolescent psychiatrist based on DSM IV criteria. The primary evaluations were as follows:

1. To verify the diagnosis and examine comorbid disorders, a skilled psychologist conducted the semi-structured interview of the Kiddie-Schedule for Affective Disorders and Schizophrenia-Present and Lifetime version (K-SADS-PL).
2. Young Mania Rating Scale (YMRS) was completed to determine the intensity of the symptoms of mania in the BD group.

3. With respect to the high prevalence of attention deficit-hyperactivity disorder (ADHD) in patients with BD, we used Conner's Parent Rating Scale-Revised (CPRS-R) to evaluate the related symptoms.

4. Raven's progressive matrices test was used to assess non-verbal intellectual ability.

5. After 2-3 weeks, the YMRS was conducted again. If the score had been reduced to eight or less, it was considered as an indicator of partial remission and patient's readiness to cooperate in doing ToM tests. Then, the participants were asked to attend the neurocognitive lab at Roozbeh hospital to take the Happe Strange Stories test, which was conducted by a trained psychologist.

The researchers did not intervene in the treatment process, but recorded the prescribed medications. The healthy group was matched with the BD adolescents based on their age, gender and intelligence. The Raven's progressive matrices, K-SADS-PL, CPRS-R, and Happe Strange Stories test were also conducted in this group.

Research Instruments

Happe Strange Stories Test: This test (28) has been used as an advanced task of ToM assessment. It consists of five groups of stories including mental states, human, animal, physical, and unlinked sentences. The stories were displayed on a laptop screen while the participants were listening to the narrator. Then they were asked to answer the questions about the stories. All answers were recorded as well as written down by the examiner. Answers were scored "2" if the participants had mentioned the main reason in the story process, and "1" if they pointed to it partially, and "0" if their explanations were wrong or irrelevant. The Persian version of this test has been validated on 399 school-aged children in Tehran; the internal consistency (coefficient of Alpha Cronbach) was .080 and the test-retest reliability was good ($r = 0.713$, $p = 0.001$) (29).

Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version (K-SADS-PL): This is a semi-structured interview which evaluates the current and lifetime psychiatric disorders and intensity of symptoms in children and adolescents (30). Shahrivar et al. (2010) (31) found this instrument to have a good-to-excellent concurrent validity in diagnosing current major disorders; its test-retest reliability in diagnosing ADHD and ODD was also excellent.

Young Mania Rating Scale (YMRS): This instrument was used to evaluate the intensity of mania symptoms. This instrument, scores 28 symptoms of mania on a 6-point Likert-type scale ranging from 0-5. The internal consistency of this instrument was found to be good (32). Shafiee et al. (33) found the concurrent validity of YMRS to be 0.87 and its validity and reliability to be acceptable for research and clinical purposes.

Conners' Parent Rating Scale-Revised-Short Form (CPRS-R: S): This is a 27-item questionnaire (34) which is completed by parents and produces

oppositonality, inattention problems, hyperactivity-impulsivity, and the ADHD indices. Tehrani-Doost et al. confirmed the validity of this questionnaire to differentiate a healthy group from patients with ADHD (unpublished).

Raven's Progressive Matrices (RPM): This test includes a sequence of image patterns arranged based on a special logic. Participants should complete each pattern by choosing a picture from several pictures. Rahmani (1386) has found psychometric properties of this test in Iran (35) and found that it has good validity and reliability.

Statistical Analysis

We performed the independent t test to compare the two groups in terms of the ToM variables using the SPSS 16. Moreover, the regression analysis was conducted between the ToM variables and ADHD symptoms. An analysis of covariance was performed to control the confounding effect of CPRS hyperactivity score.

Results

Demographic characteristics of the two groups are presented in Table 1. The two groups did not have any significant differences in terms of age, gender and intelligence. The average score of the YMRS for the BD group at the admission point was 26, and 6 in the remission phase. The two main medications used in

this group included lithium and sodium valproate. In the BD group, 14 patients were diagnosed as having ADHD and one patient had OCD. The CPRS-R: S hyperactivity subscale score was higher in the BD group ($p = 0.01$). Considering the high comorbidity of ADHD and BD in the patient group, regression analysis was conducted on ToM and CPRS-RS variables. If the results were significant, covariance analysis was used, and if not, the independent t-test to compare the means (Table 2). Because the regression analysis revealed a significant relationship between the hyperactivity-impulsivity index and animal stories variable ($t = -2.27$, $p < 0.05$), the covariance analysis was used to control the effect of this index. According to the covariance analysis, the BD group's scores were lower than the TD group's scores ($p = 0.001$).

The average scores of mental states and nature stories were significantly higher in TD group compared to the BD group ($p = 0.001$) (Table 3). Based on the two groups' answers to the unlinked sentences, there were no significant differences in terms of their comprehension. The nature and physical stories assess the individuals' understanding of causality related to animal's and human's behaviors, while the mental states stories evaluate the ability of mentalizing

Table 1. Demographic Characteristics of the Bipolar Disorder and Typically Developing Groups

	Bipolar Group (n = 30)	Typically Developing Group (n = 30)	t	p
Gender	Boys = 9 Girls = 21	Boys = 9 Girls = 21		
IQ (mean and SD)	107.3 (11.15)	111.8 (10.55)	0.09	-1.71
Age (year) (mean and SD)	15.7 (1.48)	15.4 (1.67)	0.09 0.57	-1.71 0.57

Table 2. The Results of the Regression Analysis between the Strange Stories Test and CPRS-RS* Hyperactivity-Impulsivity Score

Strange Stories	Unstandardized Coefficients		Standard Coefficients	t	Sig.
	B	Std. Error	Beta		
Mental states	-0.351	1.051	-0.059	-0.334	0.740
Human	0.033	1.080	0.005	0.031	0.976
Animal	-2.087	0.919	-0.464	-2.271	0.027
Nature	1.294	0.974	0.243	1.329	0.189
Unlinked sentences	0.797	0.636	0.180	1.254	0.215

*CPRS-RS: Conners' Parent Rating Scale-Revised Short Form

Table3. Comparison of Strange Stories Test Scores between the Two Groups

Strange stories	Group	Number	Mean	Standard deviation	DF	T	Sig
Physical	BD	30	10.66	2.73	58	-1.98	0.06
	TD	30	11.08	1.76			
Mental states	BD	30	10.03	2.74	58	-3.63	0.001
	TD	30	12.16	1.76			
Nature	BD	30	9.86	3.04	58	-2.86	0.001
	TD	30	11.8	2.09			
Unlinked sentences	BD	30	8.63	3.71	58	-1.64	0.1
	TD	30	10.36	2.31			

Discussion

Considering the persistence of social problems in youths with BD during the euthymic period, we compared the ability to understand others' mental states in adolescents with manic or mixed BD and in healthy group using an advanced ToM task, the Happe Strange Stories test.

To our knowledge, our study was the first to examine ToM ability among adolescents with BD during normal mood period. As hypothesized, our findings showed that ToM of the participants with BD was weaker in the euthymic phase compared to the normal developing group.

Bipolar disorder mostly appears during adolescence, a period to begin establishing friendly and intimate relationships with peer groups (3). Although the prominent symptoms of BD are emotional, evidence shows that this disorder primarily results from cognitive dysfunction. Consequently, problems in social relationships are caused by dysfunction in cognitive and emotional circuits in the brain (36). In fact, emotional expressions of BD originate from an impairment in cognitive control of these emotions (37). Moreover, it seems that the functional deficiency of the neural systems involved in BD play a role in ToM. Neural circuits involved in ToM include the cingulate cortex (monitoring the correct and incorrect selections), the medial prefrontal cortex (the ability of self-reference), and the orbitofrontal cortex (evaluating and processing emotional stimuli) (38). Therefore, considering the low capacity of monitoring others and their intentions, the presence of psychotic symptoms such as control and persecutory delusions, disorganized thought and speech, and some other behavioral symptoms in patients with bipolar disorder are explainable (39).

Evidence is stronger for ToM impairment during the periods of elation and depression in BD (19). Although some findings confirm difficulties in understanding other people's mental states only in the period of abnormal mood (14, 15 and 16), some authors indicated that this deficit continues even into the period in which symptoms subside (17 and 18).

Different reasons have been suggested to explain ToM deficits in euthymic phase of BD (40). Of these

explanations is that the persistence of ToM impairment into the euthymic period results from subliminal mood symptoms which have not been cured completely, but the condition is not severe enough to be diagnosed as an active period of mood disorder. On the other hand, socio-emotional dysfunction may occur before the onset of mania in individuals with BD. Whitney et al. (2013) (41) compared a group of children and adolescents with a parent diagnosed with BD to individuals who had no history of personal or family psychopathology and found numerous social deficits in the high-risk group. They suggested that ToM and other social impairments in the high-risk children might be due to the differences in innate brain functioning underlying socio-emotional abilities or secondary to mood dysregulation affecting these youths' normal development.

Although some of the cognitive abilities (e.g., executive functions) decrease as age increases (42) and this decrease occurs faster in BD, including attention and problem-solving (43), the increase of age does not make ToM ability to decrease. In contrast, research indicates that age has a determining role in predicting the ability of conceptualization (44). Using the Strange Stories test on primary school children showed an age effect to predict ToM ability. Older children had higher scores in mentalizing stories, and some abilities would not be observed before a higher age level (45). Therefore, any disruption in the development of social cognition including ToM may lead to interpersonal problems. Emergence of BD during adolescence can impair this trajectory of socio-emotional maturation.

Conclusion

Bipolar disorder in adolescents is associated with social cognition problems which continue into euthymic phase. Theory of mind deficit plays a great role in social impairment seen in youths with remitted BD. Therefore, early evaluation and improvement of social cognition abilities in adolescents with BD may be helpful in preventing their greater functional deterioration.

Limitations

This study should be interpreted in light of some limitations. First, because of the ethical issues, we continued prescribed medications, a factor which could have affected the participants' cognitive functioning. Second, ToM test was not performed during the acute mood episode, so comparing ToM ability in acute and remitted periods was not possible. Third, co-occurrence of ADHD with BD in our participants limited the generalizability of the findings, although it was controlled as a confounding factor using the statistical methods. Fourth, the sample size was rather low; therefore, the results should be considered with caution. Conducting longitudinal studies to explore ToM during different phases of BD will be of great use.

Acknowledgment

We express our sincere thanks to all participants in this research. We also thank the administrators of the Maktabe Qurani School who permitted the students of the Shahed group to participate in this study. Finally, we extend our thanks to all the staff of the Child and Adolescent Psychiatry Unit and the Neurocognitive Laboratory, especially Azar Mohammadzadeh at Roozbeh hospital.

This study was part of the first author's thesis in obtaining MSc. degree in clinical psychology at Tehran University of Medical Sciences. There was no funding for this research.

Conflict of Interest

No conflict of interest for none of the authors.

References

1. Merikangas KR, Pato M. Recent developments in the epidemiology of Bipolar disorder in adults and children: Magnitude, correlates, and future directions. *Clinical Psychology: Science and Practice*. 2009; 16:121-133.
2. Lewinsohn PM, Seeley JR, Buckley ME, Klein DN. Bipolar disorder in adolescence and young adulthood. *Child and adolescent psychiatric clinics of North America* 2002; 11: 461-475, vii.
3. Jerrell JM, Shugart MA. Community-based care for youths with early and very-early onset bipolar I disorder. *Bipolar Disord* 2004; 6: 299-304.
4. Brissos S, Dias VV, Carita AI, Martinez-Arán A. Quality of life in bipolar type I disorder and schizophrenia in remission: clinical and neurocognitive correlates. *Psychiatry Research* 2008; 160: 55-62.
5. Duax JM, Youngstrom EA, Calabrese JR, Findling RL. Sex differences in pediatric bipolar disorder. *The Journal of Clinical Psychiatry* 2007; 68: 1565-1573.
6. Dickerson FB, Sommerville J, Origoni AE, Ringel NB, Parente F. Outpatients with schizophrenia and bipolar I disorder: Do they differ in their cognitive and social functioning? *Psychiatry Res* 2001; 102: 21-27.
7. Jamrozinski K. Do euthymic bipolar patients have normal cognitive functioning? *Current Opinion in Psychiatry* 2010; 23: 255-260.
8. Brotman MA, Guyer AE, Lawson ES, Horsey SE, Rich BA, Dickstein DP, et al. Facial emotion labeling deficits in children and adolescents at risk for bipolar disorder. *The American Journal of Psychiatry* 2008; 165: 385-389.
9. Green MJ, Cahill CM, Malhi GS. The cognitive and neurophysiological basis of emotion dysregulation in bipolar disorder. *Journal of Affective Disorders* 2007; 103: 29-42.
10. Premack D, Woodruff G. Does the chimpanzee have a theory of mind? *Behavioral and Brain Sciences* 1978; 1: 515-526.
11. Baron-Cohen S, Wheelwright S, Hill J, Raste Y, Plumb I. The "Reading the Mind in the Eyes" Test revised version: a study with normal adults, and adults with Asperger syndrome or high-functioning autism. *Journal of Child Psychology and Psychiatry, and Allied Disciplines* 2001; 42: 241-251.
12. Baron-Cohen S, Belmonte MK. Autism: a window onto the development of the social and the analytic brain. *Annu. Rev. Neurosci.* 2005; 28: 109-126.
13. Rocca CC, Heuvel E, Caetano SC, Lafer B. Facial emotion recognition in bipolar disorder: a critical review. *Revista brasileira de psiquiatria (Sao Paulo, Brazil: 1999)* 2009; 31: 171-180.
14. Kerr N, Dunbar RI, Bentall RP. Theory of mind deficits in bipolar affective disorder. *Journal of Affective Disorders* 2003; 73: 253-259.
15. Montag C, Ehrlich A, Neuhaus K, Dziobek I, Heekeren HR, Heinz A, et al. Theory of mind impairments in euthymic bipolar patients. *Journal of Affective Disorders* 2010; 123: 264-269.
16. Olley AL, Malhi GS, Bachelor J, Cahill CM, Mitchell PB, Berk M. Executive functioning and theory of mind in euthymic bipolar disorder. *Bipolar Disord* 2005; 7 Suppl 5: 43-52.
17. Bora E, Vahip S, Gonul A, Akdeniz F, Alkan M, Ogut M, et al. Evidence for theory of mind deficits in euthymic patients with bipolar disorder. *Acta psychiatrica Scandinavica* 2005; 112: 110-116.
18. Wolf F, Brune M, Assion HJ. Theory of mind and neurocognitive functioning in patients with bipolar disorder. *Bipolar Disord* 2010; 12: 657-666.

19. Bora E, Berk M. Theory of mind in major depressive disorder: A meta-analysis. *Journal of Affective Disorders* 2016; 191: 49-55.
20. Birmaher B, Axelson D. Course and outcome of bipolar spectrum disorder in children and adolescents: a review of the existing literature. *Dev Psychopathol* 2006; 18: 1023-1035.
21. Goldstein TR, Birmaher B, Axelson D, Goldstein BI, Gill MK, Esposito-Smythers C, et al. Psychosocial functioning among bipolar youth. *Journal of Affective Disorders* 2009; 114: 174-183.
22. Pine DS, Guyer AE, Goldwin M, Towbin KA, Leibenluft E. Autism spectrum disorder scale scores in pediatric mood and anxiety disorders. *Journal of the American Academy of Child and Adolescent Psychiatry* 2008; 47: 652-661.
23. Birmaher B, Axelson D, Goldstein B, Monk K, Kalas C, Obreja M, et al. Psychiatric disorders in preschool offspring of parents with bipolar disorder: the Pittsburgh Bipolar Offspring Study (BIOS). *The American Journal of Psychiatry* 2010; 167: 321-330.
24. Whitney J, Howe M, Shoemaker V, Li S, Marie Sanders E, Dijamco C, et al. Socio-emotional processing and functioning of youth at high risk for bipolar disorder. *Journal of Affective Disorders* 2013; 148: 112-117.
25. Correll CU, Penzner JB, Frederickson AM, Richter JJ, Auther AM, Smith CW, et al. Differentiation in the preonset phases of schizophrenia and mood disorders: evidence in support of a bipolar mania prodrome. *Schizophrenia Bulletin* 2007; 33: 703-714.
26. Schenkel LS, Marlow-O'Connor M, Moss M, Sweeney JA, Pavuluri MN. Theory of mind and social inference in children and adolescents with bipolar disorder. *Psychol Med* 2008; 38: 791-800.
27. Schenkel LS, Chamberlain TF, Towne TL. Impaired theory of mind and psychosocial functioning among pediatric patients with type I versus type II bipolar disorder. *Psychiatry Research* 2014; 215: 740-746.
28. White S, Hill E, Happe F, Frith U. Revisiting the strange stories: revealing mentalizing impairments in autism. *Child Development* 2009; 80: 1097-1117.
29. Shahrivar Z, Tehrani Doost M. Evaluation of understanding others's mental states in primary school children using the "Happe strange stories" and assessment of its psychometric properties, (a research report) 2015.
30. Kaufman J, Birmaher B, Brent D, Rao U, Flynn C, Moreci P, et al. Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version (K-SADS-PL): initial reliability and validity data. *Journal of the American Academy of Child and Adolescent Psychiatry* 1997; 36: 980-988.
31. Shahrivar Z, Kousha M, Moallemi S, Tehrani-Doost M, Alaghband-Rad J. The Reliability and Validity of Kiddie-Schedule for Affective Disorders and Schizophrenia-Present and Life-time Version-Persian Version. *Child and Adolescent Mental Health* 2010; 15: 97-102.
32. Young RC, Biggs JT, Ziegler VE, Meyer DA. A rating scale for mania: reliability, validity and sensitivity. *The British journal of Psychiatry* 1978; 133: 429-435.
33. Shafiee K, Barakatain M, Bashardoost N, Mahmoodi-gharaei J. Comparison of clinical response rate in patients with acute mania while prescribing oral sodium valproate using loading and gradual titration methods. *Journal of Research in Medical Sciences*. 2003; 8:25-29.
34. Conners CK, Sitarenios G, Parker JD, Epstein JN. The revised Conners' Parent Rating Scale (CPRS-R): factor structure, reliability, and criterion validity. *Journal of Abnormal Child Psychology* 1998; 26: 257-268.
35. Rahmani J. The reliability, validity & normalization of Raven's progressive matrices test among the students of Azad Khorasgan University. *Journal of Knowledge and Research in Psychology*. 2008; 34:61-74.
36. Phillips ML, Ladouceur CD, Drevets WC. A neural model of voluntary and automatic emotion regulation: implications for understanding the pathophysiology and neurodevelopment of bipolar disorder. *Molecular Psychiatry* 2008; 13: 829, 833-857.
37. Green MJ, Cahill CM, Malhi GS. The cognitive and neurophysiological basis of emotion dysregulation in bipolar disorder. *Journal of Affective Disorders* 2007; 103: 29-42.
38. Blair RJ. Neurobiological basis of psychopathy. *British journal of psychiatry*: 2003; 182: 5-7.
39. Rolls ET. The functions of the orbitofrontal cortex. *Brain and Cognition* 2004; 55: 11-29.
40. Judd LL, Akiskal HS, Schettler PJ, Endicott J, Leon AC, Solomon DA, et al. Psychosocial disability in the course of bipolar I and II disorders: a prospective, comparative, longitudinal study. *Archives of General Psychiatry* 2005; 62: 1322-1330.
41. Whitney J, Howe M, Shoemaker V, Li S, Marie Sanders E, Dijamco C, et al. Socio-emotional processing and functioning of youth at high risk for bipolar disorder. *Journal of Affective Disorders* 2013; 148: 112-117.
42. Charlton RA, Barrick TR, Markus HS, Morris RG. Theory of mind associations with other cognitive functions and brain imaging in normal aging. *Psychology and Aging* 2009; 24: 338-348.
43. Mahlberg R, Adli M, Bschor T, Kienast T. Age effects on Trail Making Test during acute depressive and manic episode. *The International Journal of Neuroscience* 2008; 118: 1347-1356.
44. Buitelaar JK, Van der Wees M, SWAAB-BARNEVELD H, Van der Gaag RJ. Theory of mind and emotion-recognition functioning in autistic spectrum disorders and in psychiatric

- control and normal children. *Development and Psychopathology* 1999; 11: 39-58.
45. O'Hare AE, Bremner L, Nash M, Happe F, Pettigrew LM. A clinical assessment tool for advanced theory of mind performance in 5 to 12 year olds. *Journal of Autism and Developmental Disorders* 2009; 39: 916-928.