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Alexithymia predicts poorer social and everyday functioning in schizophrenia and bipolar disorder

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Abstract

Alexithymia, or the inability to identify and describe one's emotions, is significantly higher in bipolar disorder (BD) and schizophrenia (SZ), compared to healthy controls (HC). Alexithymia has also been observed to predict psychosocial functioning in SZ. We investigated whether alexithymia predicted social and everyday functioning in BD, as well as transdiagnostically in HC, BD, and SZ patients. 56 BD, 45 SZ, and 50 HC were administered and compared on tests measuring neurocognition, social cognition, functioning and alexithymia. We conducted linear regressions assessing whether alexithymia predicted functional outcomes in BD. Next, we conducted hierarchical stepwise linear regressions investigating the predictive ability of neurocognition, social cognition and alexithymia on everyday and social functioning in our overall sample. BD and SZ patients were comparable on most demographics and demonstrated higher alexithymia compared to HCs. In BD, alexithymia predicted social functioning only. In the overall sample, difficulty identifying and describing feelings predicted everyday functioning; difficulty describing feelings predicted social functioning. Results suggest that aspects of alexithymia significantly predict functioning among these psychiatric groups, above and beyond the contributions of previously identified factors such as neurocognition and social cognition. Results may aid in developing proper interventions aimed at improving patients' ability to articulate their feelings.

Keywords

bipolar; schizophrenia; neurocognition; social cognition; functioning; alexithymia; psychosis

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1. INTRODUCTION

Bipolar disorder (BD) primarily features chronic and recurrent affective episodes that negatively affect functional outcome in at least two-thirds of patients (Huxley and Baldessarini, 2007). Additionally, BD patients also present with impaired psychosocial functioning (MacQueen, Young, and Jaffe, 2008; Sanchez-Moreno et al., 2009), even during affective remission. Initial clinical and demographic predictors of functional status have included older age, depressive symptoms, number of previous mixed episodes and hospitalizations (Rosa et al., 2009). However, subsequent research assessing everyday functioning in BD have demonstrated limited predictive ability of clinical and demographic factors (Martinez-Aran et al., 2007; Tabarés-Seisdedos et al., 2008), suggesting that additional factors significantly contribute to functional status.

Poor overall functioning, including work, social, and everyday performance, is common among individuals with major psychiatric disorders such as BD and schizophrenia (SZ) (Ormel et al., 2008). Consistently neurocognitive deficits have been associated with lower overall functioning for both BD and SZ patients (Martinez-Aran et al., 2002; Tabarés-Seisdedos et al., 2008). Many BD patients present with impaired performance on neurocognitive domains of attention, memory, and executive function (Martinez-Aran et al., 2004; Burdick et al. 2007), deficits that are associated with poorer psychosocial and everyday functioning (Martino et al., 2009; Sanchez-Moreno et al., 2009; Burdick et al 2010). Similarly, SZ patients are impaired on most neurocognitive domains (Keefe et al., 2006) and these deficits are also associated with impaired social and occupational functioning (Bowie et al., 2010; Martinez-Aran et al., 2002). Impaired social cognition is also another predictor of poorer functional outcome, especially for SZ patients (Couture et al., 2006); this relationship exists for certain social cognitive domains, particularly emotion recognition, theory of mind, and social perception. Social cognitive deficits have also been observed in BD, particularly domains of emotion recognition and theory of mind (Bora et al., 2016; Samamé et al., 2012), although its relationship to functioning has been inconclusive (Lahera et al., 2012; Thaler et al., 2014). Current consensus supports the notion that neurocognition and social cognition are overlapping, yet partially separable constructs which contribute to functional status in a non-redundant manner (Mehta et al., 2013). Studies which have assessed the relationship between neurocognition, social cognition and functioning have observed a mediating effect of social cognition on the neurocognitive-functioning relationship in SZ, such that neurocognition predicts functional status through potential underlying social cognitive mechanisms (Schmidt et al., 2011). In BD, interestingly, social cognition has been shown to moderate this same relationship, suggesting the presence of social cognitive heterogeneity (i.e., differential neurocognitive-functioning relationships depending on the individual's social cognitive level) (Ospina et al., 2018). Overall, these relationships suggest that social cognitive ability may be dependent on more basic neurocognitive processes, both of which partially contribute to functional outcome.

While some domains of social cognition, such as theory of mind and emotion recognition, have been commonly examined in the psychiatric literature, alexithymia remains largely unexplored. Alexithymia is defined as a difficulty in recognizing and articulating the

emotional experiences of the self (Sifneos, 1972), and may relate to domains of emotion self-regulation and self-awareness (Taylor et al., 1999). Aspects of alexithymia include: 1) difficulty in identifying and describing feelings, 2) difficulty distinguishing feelings from bodily sensations, 3) a deficit in symbolic thinking, and 4) a tendency to focus attention externally. Clinically, individuals with alexithymia avoid speaking about their feelings; instead they describe the logic of their cognitive and behavioral actions. Their speech is monotonous, stilted, and lacks richness. While they may not admit to feeling clinical symptoms, such as depression or anxiety, they may complain about physical symptoms. They are also characterized by an impoverished fantasy life, impaired emotional functioning, and present with difficulty in interpersonal relationships (Taylor, 1984). Given this inability to recognize self-referential cognitive states, alexithymia has been theorized to partially represent deficits in metacognition (Dimaggio et al., 2009), with certain metacognitive strategies correlating with aspects of alexithymia (Babei et al., 2016). Studies in BD have generally shown that BD patients present with higher alexithymia scores, particularly difficulty in identifying and describing feelings, compared to healthy controls (HCs) (Herold et al., 2017; Yilmaz et al., 2016). Interestingly, studies comparing psychotic versus non-psychotic axis I disorders (as well as one study comparing BD to major depressive disorder) revealed no difference in alexithymia between the diagnostic groups (Heshmati et al., 2010; Karayağiz et al., 2016; Picardi et al., 2012), suggesting that alexithymia may not reliably differentiate between mood and psychotic disorders and may in fact be a characteristic of major psychiatric illnesses in general.

Studies in SZ have reported higher alexithymia scores compared to HCs (Cedro et al., 2001; van't Wout et al., 2007). Furthermore, recent studies have also found alexithymia to predict psychosocial functioning in SZ patients (Kimhy et al., 2012) as well as in individuals at high risk for psychosis (Kimhy et al., 2016), wherein difficulty in describing feelings accounted for a significant amount of variance in predicting psychosocial functioning above and beyond the predictive ability of neurocognitive and other social cognitive domains. Measures of metacognition have also been shown to predict psychosocial and everyday functioning in SZ (Arnon-Ribenfeld et al., 2017; Fogley et al., 2014), and like social cognition, deficits in metacognitive processes have also been shown to mediate the relationship between neurocognition and social functioning in SZ patients (Lysaker et al., 2010). However, while they may share common underlying mechanisms, social cognition and metacognition may represent distinct constructs which relate to social functioning in differing ways (Fogley et al., 2014). To date, only one study in BD has evaluated the effect of alexithymia on functioning, focusing on quality of life; higher alexithymia scores predicted lower quality of life in both BD and depressed patients (Karayağiz et al., 2016). However, it remains unclear whether alexithymia predicts other functional outcomes in BD, as has been shown in SZ.

Most studies have generally shown greater alexithmyia in psychiatric populations compared to HCs, with little to any distinction between specific major psychiatric disorders. Some studies have also demonstrated an association between alexithymia and functioning, particularly in SZ. However, alexithymia research in BD is scant, particularly regarding diagnostic comparisons of alexithymia between BD and other psychiatric disorders, as well as determining alexithymia's predictive ability of functional outcomes in BD. The current study aimed to extend the literature regarding alexithymia in a BD sample, specifically: 1) to

compare BD, SZ, and HC groups on alexithymia domains, and 2) assess whether alexithymia domains predict functional outcomes within a BD group. First, we hypothesized that BD would not be distinguishable from SZ on alexithymia domains, given prior research (Karayağiz et al., 2016; Picardi et al., 2012). Second, given commonalities (i.e., clinical, genetic, and neurobiological) between BD and SZ, we posited that alexithymia would predict functioning in BD patients, since this relationship has been observed in SZ individuals (Kimhy et al., 2012). Finally, we aimed to explore the predictive ability of alexithymia above and beyond previously identified factors, such as neurocognition and social cognition, transdiagnostically in our overall sample. Since other social cognitive domains (and to some degree, metacognition) have demonstrated modulating effects on the neurocognitive-functioning relationship (Lysaker et al., 2010; Ospina et al., 2018; Schmidt et al., 2011), we hypothesized that alexithymia would account for some of the predictive variance on functional outcome in our overall sample.

2. METHODS

2.1. Participants

The sample consisted of 151 participants diagnosed with: either BD I (n=46) or BD II (n=10), schizophrenia (n=23) or schizoaffective disorder (n=22), and HC (n=50). All participants were recruited at Icahn School of Medicine at Mount Sinai in an R01-funded study between 2012 to 2017; recruitment advertisements were posted throughout the metropolitan, NYC area. All procedures were approved by the Institutional Review Board and we obtained written informed consent from all participants. Inclusion criteria for participants included: 1) diagnosis of BD I, BD II (BD), schizophrenia, or schizoaffective disorder (SZ) using the Structured Clinical Interview for DSM-IV (SCID-IV) (First et al., 2002), 2) and age 18 to 65 years. We recruited HCs separately as presenting without evidence of any Axis I disorder. Exclusion criterion for HCs included presence of an Axis I disorder among the participants' first-degree relatives based on self-report. Exclusion criteria for all participants were: 1) history of central nervous system trauma, neurological disorder, or attention deficit hyperactivity disorder, 2) recent severe substance abuse/dependence disorder in the past 3 months, determined using the SCID, 3) electroconvulsive therapy in the past 12 months, 4) an active, unstable medical problem (e.g., a diagnosis of metastatic brain cancer, multiple sclerosis), 5) an estimated, premorbid IQ<70 (using the Wide Range Achievement Test-3rd Edition [WRAT] Reading subtest (Wilkinson, 1993), and 6) individuals taking medications with known adverse cognitive affects or cognitive enhancers.

2.2. Measures

Alexithymia—Alexithymia was assessed using the Toronto Alexithymia Scale (TAS-20) (Bagby et al., 1994), a 20-item self-report measure that evaluates 3 subscales: 1) difficulty identifying feelings, 2) difficulty describing feelings, and 3) externally-oriented thinking. Each item is rated on a 5-point scale (from 1='strongly disagree' to 5='strongly agree'); subscales are computed by summing relevant items, and a total alexithymia score is computed by summing responses to all 20 items, with greater TAS scores representing greater alexithymia. The TAS-20 has demonstrated solid internal consistency and reliability.

Clinical—DSM-IV BD or SZ diagnoses (or lack of Axis I diagnosis in HCs), presence of lifetime psychotic features, illness length in years, and psychiatric medication use were ascertained from the SCID-IV by highly trained psychologists. Current manic and depressive symptomatology were evaluated using the Young Mania Rating Scale (YMRS) (Young et al., 1978) and Hamilton Rating Scale for Depression (HRSD) (Hamilton, 1960), respectively.

Neurocognition—We assessed neurocognition using the MATRICS Consensus Cognitive Battery (MCCB) (Nuechterlein and Green, 2006). The MCCB contains 10 tests measuring 7 domains: 1) processing speed (Brief Assessment of Cognition in Schizophrenia, Trail Making Test Part A, and semantic fluency), 2) attention and vigilance (Continuous Performance Test-Identical Pairs), 3) working memory (Weschler Memory Scale spatial and letter number span), 4) verbal learning (Hopkins Verbal Learning Test-Revised [HVLT-R]), 5) visual learning (Brief Visuospatial Memory Test-Revised), 6) reasoning and problem solving (Neuropsychological Assessment Battery Mazes subtest), and 7) social cognition (Mayer-Salovey-Caruso Emotional Intelligence Test [MSCEIT]). We replaced the HVLT-R with the California Verbal Learning Test (CVLT), as it has demonstrated better sensitivity in determining verbal learning deficits in a BD (i.e., less impaired) population (Yatham et al., 2010; Burdick et al. 2011). The battery generally takes 70 minutes to complete in a single session. Scores are expressed in T-scores with a mean of 50 and a standard deviation of 10. A global neurocognitive composite score was calculated by averaging the T-scores of all MCCB domains and CVLT, with the exception of the MSCEIT.

Social Cognition—The MCCB assesses social cognition using the MSCEIT Managing Emotions Subtest, which measures emotion management and emotion regulation by presenting vignettes of various social situations; participants are instructed to choose the most appropriate social response to achieve preferred outcomes. We assessed additional social cognitive domains, such as theory of mind, using the Reading the Mind in the Eyes Test (RMET) (Baron-Cohen et al., 2001). The RMET consists of 36 black-and-white photographs of pairs of eyes with the rest of the face obscured, each associated with a forced-choice emotion label; each correct answer scored one point. We evaluated facial affect recognition by administering the Emotion Recognition Task (ERT), a computer-based subtest of the Cambridge Neuropsychological Test Automated Battery (CANTAB) (Robbins et al., 1994). The ERT presents 90 images of actors mimicking one of the 6 universal emotional expressions in two blocks, for a total of 180 stimuli. After each stimulus presentation (200 ms), the participant is instructed to choose among the emotional labels displayed on the screen: happiness, sadness, anger, disgust, fear and surprise. The ERT provides the number and percentage of correctly identified facial expressions. All neurocognitive and social cognitive measures were administered by highly trained clinical research coordinators under extensive supervision.

Functioning—We evaluated everyday functioning using the World Health Organization Disability Assessment Schedule (WHODAS 2.0) (Üstün, 2010), a 36-item measure that assesses disability severity across 6 domains in the past 30 days: 1) understanding and communicating, 2) getting around, 3) self-care, 4) getting along with others, 5) life activities,

and 6) participation in society. Given low employment rates in our sample, we utilized the alternate 32-item calculation omitting employment. We computed domain scores by summing the relevant item responses, where greater WHODAS scores represented worse functioning. We also assessed social functioning using the Social Adjustment Scale-Self Report (SASSR) (Weissman, 1999), a 54-item questionnaire designed to measure performance over the past 2 weeks in 6 role areas: 1) work (either for paid work, unpaid housework, or student), 2) social and leisure activities, 3) relationships with extended family, 4) marital or intimate partner role, 5) parental role, and 6) role in the familial unit, including perceptions of financial support. Each question is rated on a 5-point scale, and means are computed for individual role areas as well as an overall functioning mean; higher SAS scores represent worse social functioning. Role areas not relevant to the participant may be skipped; therefore, role area means are computed for all items completed by the participant.

2.3. Statistical Analyses

We first compared BD, SZ, and HCs on demographics, symptoms, and premorbid IQ using chi-squares and ANOVAs, as appropriate. We compared TAS scales between diagnostic groups using ANCOVAS, controlling for significant clinical and demographic variables. Additional analyses included diagnostic group comparisons using ANCOVAs and MANCOVAs to compare neurocognitive, social cognitive and functioning scores, controlling for: WRAT-3, YMRS, HRSD, and age. Follow-up comparisons for ANOVAs were corrected using the Tukey criterion, while follow-up multiple comparisons for ANCOVA/MANCOVAs were corrected using the Least Significant Difference method. To assess the relationship between illness course and our variables of interest, we conducted correlations between age, age of onset, length of illness (computed by subtracting age of onset from age), and number of mood episodes with TAS and functioning variables. In order to evaluate whether alexithymia predicts functioning (both WHODAS and SAS total scores as dependent variables) in a BD sample, we conducted separate hierarchical linear regression models with demographic and clinical covariates (WRAT-3, YMRS, HRSD, age, psychosis history) in block 1, and the alexithymia variables (TAS-20) in block 2. In order to discover which factors best predict functioning (both WHODAS and SAS total scores as dependent variables) in our overall sample, we conducted separate hierarchical stepwise linear regressions with demographic and clinical covariates (WRAT-3, YMRS, HRSD, age, sex, race (i.e., Caucasian vs. non-Caucasian), diagnosis, psychosis history) in block 1, neurocognitive variables (MCCB domains, CVLT, and the composite neurocognitive score) in block 2, social cognitive variables (MSCEIT, RMET, and ERT) in block 3, and the alexithymia variables (TAS-20) in block 4. Neurocognitive variables were T-scored based on a normative sample, while the remaining variables represented raw scores. All statistical analyses were conducted using IBM SPSS Statistics 23 (IBM corp., Armonk, NY, USA). Alpha was set at 0.05; all analyses were two-tailed.

3. RESULTS

3.1. Sample Characteristics

Diagnostic group comparisons for demographics, clinical and alexithymia scores are presented in Table 1. BD, SZ and HC groups performed comparably on most demographics;

however, HCs were significantly younger than SZs. Also, SZ patients completed fewer years of education compared to the BD and HC groups. Both BD and SZ groups reported higher depressive and manic symptoms and worse premorbid IQ compared to HCs. Regarding alexithymia, both BD and SZ groups had more difficulty in describing and identifying feelings, with no difference in externally-oriented thinking. Overall, both BD and SZ patients presented with greater alexithymia total scores compared to HCs (see Table 1).

3.2. Diagnostic Comparisons of Cognition and Functioning Measures

Diagnostic group comparisons for cognitive and functioning scores are presented in Table 2. Overall, BD and SZ groups performed worse on most neurocognitive domains and the composite neurocognition score, compared to HCs. The SZ group scored significantly lower on the MSCEIT than the BD and HC groups; no other social cognitive measures differed between the diagnostic groups. Diagnostic group comparisons for both WHODAS and SAS total scores showed that both BD and SZ patients scored worse on the WHODAS (F(2, 138)=15.56, p<.001), and the SAS (F(2, 140)= 11.90, p<.001); there were no differences between BD and SZ groups for either functioning measure total scores. Given no difference in overall everyday and social functioning between BD and SZ groups, subsequent regression models using the overall sample (i.e., BD, SZ, and HC) included diagnosis as a dichotomous predictor variable (i.e., psychiatric case [BD/SZ] vs. control [HC] group).

3.3. Relationships between illness course, alexithymia and functioning

Correlations between age, age of onset, illness length in years, total number of mood episodes (for BD patients only), alexithymia, and functioning variables are presented in Table 3. In our BD sample, age negatively correlated with TAS items of difficulty identifying and describing feelings, while age of onset negatively correlated with the TAS domain of externally-oriented thinking and the total TAS score. Also, age of onset correlated negatively with social functioning, specifically, relationships with extended family and the SAS total score. In the SZ group, only participant age correlated with everyday functioning, specifically activities in the home; no other illness course factors associated with alexithymia or functioning.

3.4. Regression Models Predicting Functioning

3.4.1. Regression predicting functioning in BD only—The hierarchical linear regression evaluating whether alexithymic factors predict everyday functioning (i.e., WHODAS) scores in our BD group yielded a significant model accounting for 46% of the variance (F(8, 55)=4.90, p<0.001). However, no alexithymia domains significantly predicted everyday functioning, with only externally-oriented thinking achieving trend-level significance (β=0.21, p=0.09). Significant covariates in this model included only depressive symptomatology (β=0.39, p=0.004). Results for the hierarchical linear regression evaluating whether alexithymia domains predict social functioning (i.e., SAS) in our BD group revealed an overall significant model accounting for 42.5% of the variance (F(8, 55)=4.34, p=0.001). Significant alexithymic predictors included the ability to describe feelings ((β=0.53, p=0.002) and externally-oriented thinking ((β=0.26, p=0.04). The only significant covariate in this model included premorbid IQ (β=0.36, p=0.01).

3.4.2. Regression predicting functioning in the overall sample—Hierarchical stepwise regressions investigating predictive factors of everyday and social functioning scores in our overall sample are shown in Table 4. For the model predicting global everyday functioning (i.e., WHODAS), significant clinical predictors included depressive symptomatology and diagnosis. Among neurocognitive domains, processing speed significantly predicted everyday functioning; for social cognitive variables, only the % correct of happy faces on the ERT predicted everyday functioning. Finally, the alexithymia dimensions measuring difficulty identifying feelings and difficulty describing feelings both predicted WHODAS scores; this model was significant, accounting for 69% of the variance ($F(19, 127)=12.34$, $p<0.001$). For the model predicting overall social functioning (i.e., SAS) in our total sample, significant clinical predictors included depressive symptoms and diagnosis. Working memory was the only significant neurocognitive predictor of social functioning, while none of the social cognitive measures added significantly to the model. Finally, the alexithymia dimension indexing difficulty describing feelings predicted the SAS total score; this model was significant, accounting for 52% of the variance ($F(19, 131)=6.34$, $p<0.001$).

4. CONCLUSION

The present study is the first to investigate differences in alexithymia between BD, SZ, and HC groups, as well as examine the predictive ability of alexithymia on functioning in BD. Additionally, we aimed to identify demographic, clinical, neurocognitive and social cognitive (including alexithymia) predictors of everyday and social functioning for all diagnostic groups simultaneously. Our diagnostic groups were comparable on most demographics, with BD and SZ groups presenting with higher depressive and manic symptoms and worse premorbid IQ compared to HCs. We also found that BD and SZ groups scored higher on alexithymia, particularly describing and identifying feelings, as well as the total alexithymia score, compared to HCs. Further, age and age of onset correlated with aspects of alexithymia and social functioning in the BD group only. Difficulty in describing feelings and externally-oriented thinking were found to predict social functioning only in our BD group. Finally, hierarchical stepwise regression models predicting everyday and social functioning suggest that certain alexithymia domains, specifically difficulty describing feelings, independently contributed to prediction models of functioning (in addition to diagnostic status and depressive symptomatology), with more severe alexithymia predicting a lower level of functioning.

Diagnostic comparisons of neurocognitive domains generally demonstrated comparable performance between SZ and BD groups, who both performed worse on domains of processing speed, attention/vigilance, verbal learning and the overall neurocognitive composite score, compared to HCs. However, evaluation of group means demonstrated slightly better performance in the BD group compared to the SZ group on these domains, which has been found previously (Altschuler et al., 2004; Daban et al., 2006); limited sample sizes may offer one explanation for not achieving statistical significance on these comparisons. Regarding social cognition, the SZ group performed worse on the emotion regulation task (i.e., MSCEIT) compared to BD and HC groups, a result which is supported by prior work (Lee et al., 2013). Current results showed comparable performance on social

cognition between BD and HC groups, as has been previously evidenced (Lee et al., 2013). Interestingly, the SZ group performed as well as the BD and HC groups on the theory of mind and emotion recognition tasks. However, reviewing group means demonstrated lower performance for the SZ group on these measures; possible explanations for this result include lack of statistical power, as well as the inclusion of age, IQ, and clinical symptomatology as covariates, which have been shown to moderate impairment in both emotion recognition (Kohler et al., 2009) and theory of mind (Bora, Yucel, and Pantelis, 2009). Additionally, comparable neuro- and social cognitive performance between SZ and BD groups may be explained by the presence of cognitive heterogeneity within these patient samples. Recent studies propose that BD may be characterized by several cognitive subgroups, with some patients demonstrating intact neurocognition (similar to HCs), some patients with impairments on select neurocognitive domains, and other patients with severe impairment in most domains (similar to SZ patients) (Burdick et al., 2014). Further research also suggests social cognitive (Ospina et al., 2018) and functional (Solé et al. 2018) heterogeneity in BD. Likewise, there is some evidence of cognitive heterogeneity in SZ as well (Joyce et al., 2005). It is possible that either our BD sample is primarily comprised of lower-functioning individuals or that the SZ patients are higher functioning than is typically seen in other samples, rendering these groups indistinguishable from one another. Overall, our results are generally in line with previous research, indicating convergent evidence of neurocognitive and emotion regulation deficits as well as impaired functioning in BD and SZ, relative to HCs.

Previous studies have consistently shown greater alexithymia for BD and SZ patients, compared to HCs (Herold et al., 2017; Yilmaz et al., 2016; Cedro et al., 2001; van't Wout et al., 2007). Also, studies comparing psychotic versus non-psychotic disorders revealed no difference in alexithymia (Heshmati et al., 2010; Karayağiz et al., 2016; Picardi et al., 2012). The current results support these past studies, with BD and SZ groups performing comparably on all alexithymia domains. This finding suggests that alexithymia may be a non-specific characteristic of certain mental illnesses, particularly psychiatric disorders distinguished by deficits in cognitive processing and emotion regulation. Alternatively, these findings may also imply that certain social cognitive impairments, such as unawareness of one's own affective state, may be equally affected across specific mental illnesses. Interestingly, alexithymia scores remain stable even in remission for both mood and psychosis disorders (Picardi et al., 2012), suggesting that alexithymia may be characterized as a constant, personality trait (Martinez-Sanchez et al., 2003). One theoretical perspective classifies alexithymia into two subtypes, with type I characterized by the absence of emotional experience (including the experience's associated cognitive appraisal) and type II characterized by a selective deficit of emotional cognition with sparing of emotional experience (Bermond, 1995). Considering cognitive-emotional deficits specific to BD and SZ as well as their similar alexithymia scores, the TAS may in fact be assessing both subtypes of alexithymia, with subtype I most commonly found in SZ and subtype II in BD. Therefore, development of a subtype-specific alexithymia assessment may potentially yield differential scores between BD and SZ populations.

Past studies have found that alexithymia predicts functioning, beyond what is contributed by other factors such as neurocognition and other aspects of social cognition, particularly in SZ

(Kimhy et al., 2012; Kimhy et al., 2015). In BD, no studies to date have assessed the predictive ability of alexithymia on functioning (although alexithymia has been shown to predict worse quality of life in BD [Karayağiz et al., 2016]). Our results generally support this finding; within our BD sample, the alexithymic domains including difficulty describing feelings and externally-oriented thinking predicted social functioning; however, alexithymia was not observed to predict everyday functioning in this same group. Within our entire sample (i.e., BD, SZ and HC combined), difficulty describing feelings remained as the only significant alexithymia factor that predicted both everyday and social functioning. This would suggest that this emotional awareness deficit plays a significant role in predicting functional status among both psychiatric and non-psychiatric populations. In addition to psychiatric illness, alexithymia has also been observed to predict socio-emotional functioning in non-clinical populations (Ciarrochi et al., 2008; Mattila et al., 2009), highlighting the importance of developing therapeutic interventions targeting improvements in emotional awareness. Common neuroanatomical substrates have been found in relation to alexithymia, specifically the medial prefrontal cortex and anterior cingulate, for BD (Herold et al., 2017) and SZ (Harrison et al., 2007) patients, as well as HCs (Moriguchi et al., 2006). As such, alexithymia assessment may generally reflect deficits in these brain regions, which are critical for cognitive and affective processing. Also, alexithymia has been demonstrated to associate with specific emotion regulation strategies, such as suppression, which represents an attempt to inhibit emotion-expressive behavior (Gross, 1998). Suppression is common in psychiatric disorders such as SZ (van der Meer et al., 2009) and BD (Gruber, Harvey and Gross, 2012), which consequently has been associated with poorer social functioning (Kimhy et al., 2012). Subsequent research, therefore, is necessary to understand the potential mechanisms linking alexithymia, emotion regulation and overall functioning in SZ and BD populations. Finally, additional predictors of social and everyday functioning included diagnosis and depressive symptoms, consistent with prior work (Bonnin et al., 2010; Tabarés-Seisdedos et al., 2008).

The limitations of the current study include: the use of a cross-sectional design, which limits the ability to make causal inferences between the variables of interest and a relatively limited sample, which may affect generalizability of results. While we assessed some aspects of functioning using two commonly used measures, additional functioning tests measuring other aspects such as adaptive functioning would be useful to gain a more comprehensive understanding of the relationship between neurocognition and social cognition on functioning status. Also, while our HC group exhibits lower neurocognition (MCCB) scores compared to the normative sample, our HC group is better matched to our psychiatric groups on demographic characteristics (e.g. race) and as such, a more appropriate comparator group. We did not specifically assess for the presence of personality disorders in our participants. Alexithymia may be a typical feature of personality disorders (Grabe et al., 2004); additionally, BD patients comorbid with personality disorders may present with worse functional outcomes than those with BD alone (Dunayevich et al., 2000). Therefore, assessing for comorbid personality disorders may better aid in understanding the predictive relationships between alexithymia and functioning in BD. Finally, our functioning and alexithymia scales were self-reports; it is possible that poor scores for these measures relate to negative attitudes about the self or reflect other aspects of psychopathology. Relatedly,

functioning measures were assessed “in the laboratory” and so may have limited applicability to the patient’s “real-world” functional status. Future studies would benefit from including objective, informant-based measures, real-world measures, as well as assessing patient self-attitudes.

Our results help further our understanding of functional status in psychiatric populations. While most social cognitive research has consistently focused on specific subdomains, such as theory of mind and emotion recognition, the current study emphasizes the importance of considering alexithymia as an additional factor in determining functional status. Assessing emotional awareness, specifically difficulty in describing feelings, may serve as a promising avenue in investigating social cognition and functioning in mood and psychotic disorders, as well as non-clinical populations. Also, developing treatment strategies such as psychoeducational approaches specifically targeting alexithymia may be useful in promoting recovery and improved functional outcome.

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Highlights

- Bipolar and schizophrenia groups scored lower on cognition compared to controls.
- Bipolar and schizophrenia groups scored lower on functioning compared to controls.
- Bipolar and schizophrenia groups scored higher on alexithymia compared to controls.
- Difficulties in identifying and describing feelings predicted everyday functioning.
- Difficulty in describing feelings predicted social functioning.

Table 1.

Diagnostic Group Comparisons of Demographic, Clinical and Alexithymia Variables

				Statistics	
	BD (n=56)	**SZ (n=45)**	**HC (n=50)**	***F* or χ^2**	***p***
Diagnosis, *n*					
BD I	46	-	-		
BD II	10	-	-		
Schizophrenia	-	23	-		
Schizoaffective	-	22	-		
Sex, *n* (%)					
Males	21 (37.5)	24 (53.3)	21 (42.0)	2.63	0.27
Females	35 (62.5)	21 (46.7)	29 (58.0)		
Race, *n* (%)					
Caucasian	21 (37.5)	10 (22.2)	14 (28.0)	2.90	0.24
Non-Caucasian	35 (62.5)	35 (77.8)	36 (72.0)		
Age, years	38.89 (12.83)	44.51 (12.40)	38.06 (12.84)	3.59	0.03
					HC *v.* SZ; *p*=0.04
Age of onset, years	18.52 (6.72)	21.04 (10.18)	-	2.24	0.14
Education, years	14.88 (2.86)	13.47 (2.29)	15.38 (1.91)	7.96	0.001
					BD *v.* SZ; *p*=0.01
					HC *v.* SZ; *p*<0.001
Depressive symptoms: HRSD	5.91 (5.96)	6.53 (5.27)	0.48 (1.22)	25.06	<0.001
					HC *v.* SZ; *p*<0.001
					BD *v.* HC; *p*<0.001
Manic symptoms: YMRS	2.02 (3.50)	2.29 (4.30)	0.38 (1.26)	4.98	<0.01
					HC *v.* SZ; *p*=0.01
					BD *v.* HC; *p*=0.003
Premorbid IQ: WRAT-3	104.45 (12.51)	98.24 (13.89)	105.60 (12.73)	4.35	0.02
					BD *v.* SZ; *p*=0.05
					HC *v.* SZ; *p*=0.02
Alexithymia	**BD (n=56)**	**SZ (n=43)**	**HC (n=50)**	***F***	***p***
TAS-20 DIF	16.61 (7.78)	18.02 (6.71)	9.48 (4.06)	10.88	<0.001
					BD *v.* HC; *p*<0.001
					HC *v.* SZ; *p*<0.001
TAS-20 DDF	13.61 (4.93)	14.41 (4.66)	9.54 (4.36)	5.35	0.006
					BD *v.* HC; *p*=0.007
					HC *v.* SZ; *p*=0.003
TAS-20 EOT	18.32 (5.00)	19.67 (4.86)	16.38 (4.46)	2.27	0.11
TAS-20 Total Score	48.54 (13.86)	52.12 (12.34)	35.40 (10.42)	10.26	<0.001
					BD *v.* HC; *p*<0.001
					HC *v.* SZ; *p*<0.001

Note: Data are given as mean (standard deviation).

BD, Bipolar Disorder I/II; SZ, Schizophrenia/Schizoaffective; HC, Healthy Control; HRSD, Hamilton Rating Scale for Depression; YMRS, Young Mania Rating Scale; WRAT-3, Wide Range Achievement Test-3rd Edition; TAS, Toronto Alexithymia Scale; DIF, Difficulty identifying feelings; DDF, Difficulty describing feelings; EOT, Externally-oriented thinking. Only significant comparisons are listed.

Table 2.

Diagnostic Group Comparisons of Neurocognitive, Social Cognitive and Functioning Variables

				Statistics	
	BD	**SZ**	**HC**	***F***	***p***
Neurocognition	n=53	n=42	n=49		
Processing Speed	44.47 (11.50)	40.14 (7.93)	49.51 (12.80)	4.79	0.01 BD *v.* HC; *p*=0.05 HC *v.* SZ; *p*=0.002
Attention/Vigilance	39.02 (12.08)	39.05 (11.19)	45.90 (11.56)	5.18	0.007 BD *v.* HC; *p*=0.002 HC *v.* SZ; *p*=0.03
Working Memory	40.77 (11.08)	38.86 (12.20)	45.37 (12.0)	2.20	0.12
Visual Learning	42.32 (11.79)	39.71 (10.99)	44.73 (14.08)	1.34	0.27
Verbal Learning	47.30 (12.79)	40.58 (8.69)	48.55 (11.24)	4.88	0.01 BD *v.* SZ; *p*=0.01 HC *v.* SZ; *p*=0.004
Reasoning/Problem-Solving	46.08 (11.39)	40.76 (8.64)	43.71 (9.39)	2.44	0.09
Composite Score	43.33 (8.66)	39.85 (7.11)	46.30 (8.43)	4.29	0.02 HC *v.* SZ; *p*=0.004
Social Cognition	n=53	n=41	n=50		
MSCEIT[a]	46.48 (10.17)	38.91 (11.93)	49.22 (10.17)	3.17	0.05 BD *v.* SZ; *p*=0.02 HC *v.* SZ; *p*=0.03
RMET	25.68 (4.39)	23.20 (5.41)	25.50 (5.45)	1.09	0.34
ERT (% correct)					
Happy	69.06 (19.24)	66.34 (16.85)	64.15 (19.22)	0.06	0.94
Sad	71.67 (18.50)	67.76 (20.84)	70.81 (20.0)	0.15	0.86
Anger	78.71 (17.79)	70.81 (19.61)	75.97 (22.12)	0.41	0.66
Disgust	62.94 (19.78)	60.57 (23.84)	63.13 (25.31)	0.46	0.64
Fear	50.26 (22.0)	45.20 (21.13)	49.24 (25.14)	0.12	0.89
Surprise	55.13 (14.02)	53.47 (16.54)	53.81 (16.08)	0.77	0.46
Functioning					
WHODAS	n=56	n=41	n=50		
Communicating	23.07 (17.84)	24.80 (18.80)	6.00 (10.14)	10.36	<0.001 BD *v.* HC; *p*<0.001 HC *v.* SZ; *p*<0.001
Getting Around	18.57 (18.85)	21.10 (22.18)	4.10 (7.80)	2.71	0.07
Self-Care	12.28 (14.98)	8.08 (12.67)	0.63 (2.28)	4.95	0.01 BD *v.* SZ; *p*=0.03 BD *v.* HC; *p*=0.004
Getting Along	23.48 (20.00)	25.61 (18.51)	5.10 (8.42)	8.04	<0.001 BD *v.* HC; *p*=0.002 HC *v.* SZ; *p*<0.001
Life Activities-Home	29.46 (26.29)	16.62 (16.45)	7.87 (13.53)	8.96	<0.001 BD *v.* SZ; *p*=0.002

				Statistics	
	BD	**SZ**	**HC**	***F***	***p***
					BD *v.* HC; $p<0.001$
Participation in Society	28.91 (17.64)	24.54 (18.24)	4.50 (7.99)	13.94	<0.001 BD *v.* HC; $p<0.001$ HC *v.* SZ; $p=0.001$
Overall Score	22.63 (12.90)	20.12 (12.00)	4.70 (6.52)	15.56	<0.001 BD *v.* HC; $p<0.001$ HC *v.* SZ; $p<0.001$
SAS-SR	n=56	n=43	n=50		
Social Leisure	2.45 (0.77)	2.86 (0.72)	1.96 (0.51)	8.02	0.001 BD *v.* SZ; $p=0.004$ HC *v.* SZ; $p<0.001$
Relationships-extended family	1.97 (0.78)	2.07 (0.61)	1.46 (0.46)	4.73	0.01 BD *v.* HC; $p=0.02$ HC *v.* SZ; $p=0.004$
Total Score	2.21 (0.59)	2.38 (0.51)	1.64 (0.35)	11.90	<0.001 BD *v.* HC; $p<0.001$ HC *v.* SZ; $p<0.001$

Note: Data are given as mean (standard deviation).

BD, Bipolar Disorder I/II; SZ, Schizophrenia/Schizoaffective; HC, Healthy Control; MSCEIT, Mayer-Salovey-Caruso Emotional Intelligence Test; RMET, Reading the Mind in the Eyes Test; ERT, Emotion Recognition Test; WHODAS, World Health Organization Disability Assessment Schedule 2.0; SAS-SR, Social Adjustment Scale-Self Report.

[a] BD (n=54), SZ (n=45), HC (n=50). Only significant comparisons are listed.

Table 3.

Correlations between Illness Course, Alexithymia, and Functioning Variables

	BD (n = 56)				SZ (n = 45)		
	Age	**Age of Onset**	**Illness Length**	**Total # of Mood Episodes**	**Age**	**Age of Onset**	**Illness Length**
TAS: DIF	−0.27*	−0.26	−0.12	0.31	0.01	0.07	−0.05
TAS: DDF	−0.28*	−0.17	−0.18	0.26	0.26	−0.08	0.29
TAS: EOT	0.12	−0.26*	0.25	0.14	−0.12	0.00	−0.11
TAS: Total Score	−0.20	−0.30*	−0.04	0.32	0.05	0.01	0.04
WHODAS							
Communicating	−0.26	0.13	−0.32*	0.05	−0.07	0.05	−0.10
Getting Around	0.20	0.14	0.12	−0.05	0.19	0.04	0.14
Self-Care	−0.11	0.01	−0.12	0.09	0.12	0.04	0.08
Getting Along	−0.23	−0.14	−0.15	−0.05	0.19	0.08	0.12
Life Activities-Home	0.06	0.08	0.01	−0.12	0.30*	0.26	0.08
Participation in Society	−0.02	−0.08	0.02	0.32	0.07	0.09	−0.00
Overall Score	−0.08	0.04	−0.10	0.04	0.26	0.11	0.16
SAS-SR							
Social Leisure	−0.14	−0.11	−0.08	−0.04	−0.08	0.29	−0.29
Relationships-extended family	−0.24	−0.33*	−0.07	0.12	−0.12	0.02	−0.12
Total Score	−0.17	−0.27*	−0.03	−0.01	−0.14	0.20	−0.28

BD, Bipolar Disorder I/II; SZ, Schizophrenia/Schizoaffective; TAS, Toronto Alexithymia Scale; DIF, Difficulty identifying feelings; DDF, Difficulty describing feelings; EOT, Externally-oriented thinking; WHODAS, World Health Organization Disability Assessment Schedule 2.0; SAS-SR, Social Adjustment Scale-Self Report

* $p<.05$;

** $p<0.01$;

*** $p<0.001$.

Table 4.

Stepwise Hierarchical Linear Regressions Assessing Effects of Neurocognition, Social Cognition, and Alexithymia on Functioning

	WHODAS Total Score N=128		SAS-SR Total Score N=132	
Predictors	**B (SE)**	**β *(p)***	**B (SE)**	**β *(p)***
HRSD	1.11 (0.19)	0.41 (<0.001)	0.03 (0.01)	0.30 (0.001)
Diagnosis	−6.41 (2.06)	−0.23 (0.002)	−0.33 (0.11)	−0.28 (0.002)
Processing Speed	0.18 (0.09)	0.16 (0.04)	0.00 (0.01)	0.05 (0.56)
Attention/Vigilance	0.04 (0.09)	0.04 (0.62)	0.00 (0.01)	0.07 (0.44)
Working Memory	−0.12 (1.00)	−1.04 (0.24)	0.01 (0.01)	0.20 (0.05)
Visual Learning	−0.05 (0.08)	−0.05 (0.51)	−0.01 (0.00)	−0.14 (0.13)
Verbal Learning	−0.08 (0.08)	−0.07 (0.34)	−0.01 (0.00)	−0.10 (0.27)
Reasoning/Problem-Solving	0.02 (0.09)	0.12 (0.86)	−0.00 (0.01)	−0.03 (0.76)
MSCEIT	0.09 (0.09)	0.07 (0.98)	−0.00 (0.01)	−0.03 (0.76)
RMET	0.20 (0.20)	0.09 (0.23)	0.01 (0.01)	0.09 (0.32)
ERT% Happy	0.12 (0.05)	0.16 (0.02)	0.00 (0.00)	0.02 (0.76)
ERT% Sad	0.02 (0.05)	0.02 (0.74)	0.00 (0.00)	0.07 (0.37)
ERT% Anger	−0.09 (0.06)	−0.12 (0.12)	−0.00 (0.00)	−0.06 (0.53)
ERT% Disgust	0.00 (0.05)	0.00 (0.94)	−0.00 (0.00)	−0.12 (0.20)
ERT% Fear	0.01 (0.04)	0.02 (0.79)	−0.00 (0.00)	−0.06 (0.49)
ERT% Surprise	−0.06 (0.07)	−0.07 (0.38)	0.00 (0.00)	0.09 (0.34)
TAS-20 DIF	0.35 (0.17)	0.19 (0.04)	−0.00 (0.01)	−0.03 (0.80)
TAS-20 DDF	0.53 (0.24)	0.20 (0.03)	0.03 (0.01)	0.26 (0.02)
TAS-20 EOT	0.14 (0.18)	0.05 (0.43)	0.02 (0.01)	0.13 (0.10)
F	12 34***		6.40***	
R^2	0.69		0.52	

WHODAS, World Health Organization Disability Assessment Schedule 2.0; SAS-SR, Social Adjustment Scale-Self Report; HRSD, Hamilton Rating Scale for Depression; MSCEIT, Mayer-Salovey-Caruso Emotion Intelligence Test; RMET, Reading the Mind in the Eyes Test; ERT, Emotion Recognition Test; TAS-20, Toronto Alexithymia Scale; DIF, Difficulty identifying feelings; DDF, Difficulty describing feelings; EOT, Externally-oriented thinking; R^2, Variance.

* p<.05;

** p<0.01;

*** p<0.001.