



Altered empathic responding in major depressive disorder: Relation to symptom severity, illness burden, and psychosocial outcome

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ABSTRACT

Individuals with major depressive disorder (MDD) demonstrate deficits in multiple social cognitive domains; however, systematic investigations of empathic responding have not been performed. Twenty patients with MDD completed two measures of empathy, the Interpersonal Reactivity Index (IRI; Davis, 1980, 1983) and the Toronto Empathy Questionnaire (TEQ; Spreng et al., 2009). Relative to matched controls, patients with MDD reported significantly reduced levels of empathy measured broadly on the TEQ and specifically in cognitive ('Perspective Taking') and affective ('Empathic Concern') domains captured by the IRI. A higher illness burden (i.e., greater number of past depressive episodes) was associated with greater reductions in perspective taking ability. This study provides early evidence of impaired empathic abilities in patients with MDD that may worsen with illness progression. Alternatively, reductions in perspective taking ability may contribute to a more severe course of illness in this population. Further longitudinal work is needed to characterize the relation between social cognitive performance and social functioning in this population.

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1. Introduction

Empathy refers broadly to the ability to infer and share the feeling states of others in reference to oneself (Decety and Moriguchi, 2007), playing a central role in successful interpersonal engagement and higher social functioning (Baron-Cohen and Wheelwright, 2004). Investigators have adopted a multidimensional approach to the study of empathy, proposing that this psychological construct involves both cognitive (e.g., inferring another's mental state) and affective (e.g., affective response to the feeling state of another) components (Davis, 1983; for a review see McKinnon et al., 2007). Critically, many of the same cognitive (e.g., executive functioning; working memory) and affective (e.g., emotion comprehension) processes are affected in patients with MDD (Mikhailova et al., 1996; Landro et al., 2001; Surguladze et al., 2004; Gualtieri et al., 2006), rendering it probable that patients with this disorder will demonstrate reduced empathic abilities that rely on these same processing resources. To date, however, few studies of empathic responding have been conducted in patients with MDD. Here, we examine empathic responding in a

sample of outpatients with MDD, examining the relation of performance to symptom severity, illness burden, and psychosocial function.

Studies examining social cognitive performance in patients with MDD reveal a conflicting pattern of performance impairment and sparing. For example, a wide body of evidence reveals that patients with MDD are impaired in the recognition of affective facial expressions (see Leppänen, 2006 for a review). Here, individuals with MDD demonstrate a mood-congruent bias during facial emotion recognition tasks, showing deficits in the recognition of happy faces (Mandal and Bhattacharya, 1985; Rubinow and Post, 1992; Mikhailova et al., 1996; Suslow et al., 2001; Gotlib et al., 2004; Surguladze et al., 2004; LeMoult et al., 2009), enhanced recognition of sad facial expressions (Mandal and Bhattacharya, 1985; David and Cutting, 1990; Surguladze et al., 2004; Goeleven et al., 2006), as well as a tendency to identify neutral faces as sad relative to healthy controls (David and Cutting, 1990; Wright et al., 2009). A number of studies, however, fail to show evidence of alterations in the processing of emotional faces among patients with MDD (Gaebel and Wolwer, 1992; Mogg et al., 2000; Kan et al., 2004; Hertel et al., 2009). Patients with MDD also demonstrate a negative bias during the processing of affective prosodic stimuli by interpreting neutral prosodic emotions as negative (Kan et al., 2004) and showing enhanced recognition of sad emotional tones (Uekermann et al., 2008a). Few studies have examined theory of mind, the ability to infer the mental states (e.g., belief, intentions, emotions) of others to

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understand and predict their behavior (Premack and Woodruff, 1978) in patients with MDD. Theory of mind is a term related to but dissociable from the construct of 'cognitive empathy', and involves a cognitive understanding and appreciation of another's mental state. In these studies, actively ill patients show impairment on a variety of theory of mind tasks placing demands on cognitive and affective processing resources (Lee et al., 2005; Uekermann et al., 2008b; Wang et al., 2008). Overall, the literature concerning social cognitive performance in MDD reveals a mixed pattern of findings, underscoring the need for further investigation. The primary goal of this study is to examine specifically empathic responding in a sample of patients with MDD, an area of social cognitive performance remaining underexplored in this population.

Deficits in empathic responding have been reported in neuropsychiatric populations such as schizophrenia (Montag et al., 2007; Shamay-Tsoory et al., 2007) and autism spectrum disorders (Baron-Cohen et al., 2001; Rogers et al., 2007), however, to date, very few studies have assessed empathic responding in patients with mood disorders. Early evidence of reduced empathic capacity has been reported in individuals with bipolar disorder (Shamay-Tsoory et al., 2009; Cusi et al., 2010). Both Shamay-Tsoory et al. (2009) and our group (Cusi et al., 2010) found that relative to healthy controls, patients with bipolar disorder (BD) reported decreased cognitive empathy ('Perspective Taking') and elevated levels of affective personal discomfort in response to others' distress ('Personal Distress'), as assessed by the Interpersonal Reactivity Index (IRI; Davis, 1983). In our study, impaired affective empathic abilities were associated with greater depressive severity but not number of past mood episodes or illness duration suggesting that changes in empathic responding in bipolar disorder may represent a state, rather than trait, marker of illness. Interestingly, these alterations in affective distress were associated with reduced psychosocial functioning (as assessed at the time of testing) in our sample of BD patients, most of whom were mildly ill; it is unclear at present whether further reductions in psychosocial function would arise with more severe illness or remit over the course of euthymia.

Prior investigations provide preliminary evidence of alterations in abilities associated with empathic responding in individuals with MDD. For example, Donges et al. (2005) found that *inpatients* with acute MDD showed intact awareness of their own emotions, but reduced awareness of others' emotions compared to matched controls. This decrease in emotional awareness for others was associated with elevated symptoms of depression. Interestingly, emotional awareness improved significantly following treatment in a psychotherapeutic program targeted at recognizing emotional responses and their situational origins (Donges et al., 2005). Only one study has assessed directly the cognitive and affective components of empathy in patients with MDD. O'Connor et al. (2002) found that depressed *inpatients* reported elevated levels of distress and discomfort in response to other's negative situations on the IRI Personal Distress subscale; greater levels of depression severity were associated with higher scores on this subscale. These patients also scored significantly higher than healthy controls on self-rated measures of altruism, a process linked closely to empathy, although not directly analogous to it.

In the present study, we conducted a preliminary assessment of empathic responding in a sample of MDD *outpatients* in varying states of illness. First, we used two standardized self-rated measures of empathic responding, the Toronto Empathy Questionnaire (TEQ; Spreng et al., 2009) to assess empathic ability broadly and the IRI to specifically assess cognitive and affective facets of empathic responding. We expected that depressed patients would show impaired cognitive and affective empathic abilities, as a result of well-documented deficits in cognitive (e.g., perspective taking) and affective (e.g., emotion recognition) processing found in this patient population (Phillips et al., 2003; Lee et al., 2005; Uekermann et al., 2008a). Notably, impairments on tests of social cognition, most

prominently, theory of mind (Inoue et al., 2006), is associated with poor functional outcome in individuals with mood disorders. To date, however, there have been no studies examining the relation between cognitive and affective empathic responding and standardized measures of social functioning in patients with MDD. Hence, we examined the relation between empathic abilities and psychosocial functioning using a well-validated measure of functional outcome, the Social Adjustment Scale Self-Report (SAS-SR; Weissman and Bothwell, 1976). We predicted that similar to patients with BD, altered empathic performance in patients with MDD would be associated with impaired functioning. Finally, in light of recent findings showing that patients with a chronic and recurrent illness history show greater impairment on tests of social (McKinnon et al., 2010) and cognitive function, (e.g., Basso and Bornstein, 1999; MacQueen et al., 2002), we examined the relation between illness burden (e.g., number of depressive episodes, illness duration) and empathic responding.

2. Methods

2.1. Participants

Twenty patients who had experienced at least one prior episode of MDD (6 males and 14 females) and 20 age- and education-matched controls (7 males and 13 females) with no history of psychiatric illness participated in the present study. The demographic and clinical characteristics of the study sample are summarized in Table 1. Patients were tested in varying states of illness, allowing for an examination of the relation between symptom severity and empathic responding. Current level of symptom severity was assessed using the 17-item Hamilton Depression Rating Scale (HAM-D; Hamilton, 1960) and the Global Assessment of Functioning Scale (GAF; American Psychiatric Association, 1994). The study sample consisted of 5 euthymic patients (HAM-D 17 score less than 7), 13 patients with sub-syndromal depression (HAM-D 17 score between 7 and 14), and 2 patients with moderate depression (HAM-D 17 score between 15 and 30). Our patient sample was free of psychotic symptoms. Medication consisted of selective serotonin reuptake inhibitors ($N=7$), serotonin and noradrenaline reuptake inhibitors ($N=4$), tricyclic antidepressants ($N=3$), monoamine oxidase inhibitors ($N=2$), stimulants ($N=1$), antipsychotic drugs ($N=3$), anticonvulsants ($N=5$), benzodiazepines ($N=3$), sedative/hypnotics ($N=6$), bupropion ($N=2$), mirtazapine ($N=1$), and no medication ($N=1$). Two patients were on anti-parkinson drugs (ropinirole) for restless leg syndrome. We were not able to obtain medication information for one participant. Participants with a history of neurological disease, traumatic brain injury and/or loss of consciousness (lasting more than 60 s), electroconvulsive therapy or transcranial magnetic stimulation therapy within 1 year, substance dependence, and untreated significant medical illness were excluded.

Table 1
Clinical and demographic characteristics of study sample.

Characteristic	Controls ($n=20$)	MDD patients total sample ($n=20$)
	n	n
Sex		
Male	7	6
Female	13	14
	Mean	Mean
Age	44.5(11.2)	45.1(11.4)
Education	17.553(2.7)	15.78(2.9)
Number of affective episodes		7.3(7.8)
Onset of illness (in years)		31.7(9.4)
Duration of illness (in years)		18.8(11.4)
Ham-D score	1.33(2.7)*	9.2(5.5)*
GAF score	81.2(3.8)*	64.6(10.0)*

Values are n or mean (standard deviation).

Abbreviations: GAF, Global Assessment of Functioning Scale; Ham-D, 17-item Hamilton Depression Rating Scale; MDD, major depressive disorder.

* Significant results ($P<0.05$).

All participants provided written informed consent and the research protocol was approved by the Research Ethics Board of St. Joseph's Healthcare Hamilton/McMaster University.

2.2. Materials

The IRI (Davis, 1980, 1983) is a 28-item self-report instrument that measures both cognitive and emotional aspects of empathy. Items are rated on a scale ranging from 0 (*does not describe me well*) to 4 (*describes me very well*). The cognitive subscales comprise the Perspective Taking and Fantasy scales. Whereas the Perspective Taking (PT) scale measures the tendency to spontaneously understand the psychological point of view of others (i.e. *I sometimes find it difficult to see things from the "other guy's" point of view*), the Fantasy subscale assesses the tendency to identify with fictional characters (i.e. *I daydream and fantasize, with some regularity, about things that might happen to me*). The emotional subscales of the IRI comprise the Empathic Concern and Personal Distress scales. The Empathic Concern subscale evaluates the respondent's feelings of warmth and compassion for others (i.e. *I often have tender, concerned feelings for people less fortunate than me*). The Personal Distress scale measures self-oriented feelings of distress and discomfort in response to difficult interpersonal situations (i.e. *I sometimes feel helpless when I am in the middle of a very emotional situation*). The IRI has been shown to have good test-retest reliability, internal consistency, and adequate levels of convergence with other measures of empathy (Davis, 1980, 1983; Christopher et al., 1993).

The TEQ (Spreng et al., 2009) is a 16-item empirically-derived self-report measure. This measure represents empathy as a primarily emotional process, by tapping constructs similar to those measured by the IRI Empathic Concern scale. The TEQ has demonstrated good internal consistency, high test-retest reliability and strong convergent validity.

The *Social Adjustment Scale Self-Report* (SAS-SR; Weissman and Bothwell, 1976) is a 54-item self-rated questionnaire that assesses role performance in six domains of functioning including work/school role, social/leisure activities, relationship with extended family, marital role, parental role and membership within a family unit. Each item is scored on a 5-point scale, with higher scores indicative of greater social impairment. Individual subscale and total scores are calculated by averaging all applicable items. The SAS-SR has shown high internal consistency, good test-retest reliability, and has shown good agreement with the interviewer-rated version of this measure (Weissman and Bothwell, 1976; Davis, 1980, 1983; Christopher et al., 1993; Weissman and Staff, 1999).

2.3. Procedures and statistical analyses

These data were analyzed using a multivariate analyses of variance (MANOVA) treating Group (MDD, HC) as a fixed variable and score for each of the IRI (PT, EC, FS, PD) subscales as a dependent variable. This procedure was repeated for the SAS-SR. In order to examine group differences on the TEQ, a univariate ANOVA was conducted. Estimated effect sizes were analyzed by partial eta square values.

Partial correlations after adjusting for age and gender were computed to examine the relation between empathic responding, illness burden (e.g., depression severity, illness duration, age at onset of illness, number of depressive episodes) and social functioning. Alpha was set at 0.05 for all analyses.

3. Results

3.1. Performance on the TEQ

Relative to controls, the MDD group reported reduced levels of empathic responding as assessed by the TEQ [$F(1, 38) = 6.96$, $P = 0.01$, $\eta_p^2 = 0.16$].

3.2. Performance on the IRI

Table 2 displays the participants' performance on the IRI. Patients with MDD reported lower levels of Perspective Taking [$F(1, 38) = 7.65$, $P = 0.009$, $\eta_p^2 = 0.17$] and Empathic Concern [$F(1, 38) = 4.86$, $P = 0.03$, $\eta_p^2 = 0.11$] than did healthy controls. No other significant effects emerged.

3.3. Psychosocial functioning

As expected, the Work/Academic functioning [$F(1, 13) = 12.59$, $P = 0.004$, $\eta_p^2 = 0.49$], Membership within a Family Unit [$F(1, 13) = 4.85$, $P = 0.04$, $\eta_p^2 = 0.27$] domains, and overall social adjustment [$F(1, 13) = 5.83$, $P = 0.031$, $\eta_p^2 = 0.31$] were impaired in the MDD patients relative to controls. No other significant differences emerged.

3.4. Relation between psychosocial functioning and empathic responding

No significant relations emerged between levels of SAS-SR functioning and performance on the TEQ and IRI subscales ($P's > 0.05$).

3.5. Relation between clinical variables and empathic responding

Within the MDD group, there was evidence that lower scores on the IRI Perspective Taking scale correlated with a higher number of depressive episodes ($r = 0.60$, $P = 0.02$). No significant correlations emerged between symptom severity, burden of illness (age at onset of illness, duration of illness) and performance on any of the IRI subscales ($P's > 0.05$). No significant relations were found between performance on the TEQ and any of the clinical variables ($P's > 0.05$).

4. Discussion

To our knowledge, this is the first report of altered empathic abilities in a sample of *outpatients* with MDD. Critically, we found preliminary evidence that patients with MDD reported significantly lower levels of both cognitive (Perspective Taking) and affective (Empathic Concern) empathy relative to matched controls. A higher number of depressive episodes were also associated with reduced perspective taking abilities, suggesting a gradual worsening in the ability to mentalize about other's affective states with illness progression.

The current finding of reduced 'Perspective Taking' ability among patients with MDD is consistent with prior reports of impairments in the closely related domain of theory of mind in patients with MDD (Inoue et al., 2004; Lee et al., 2005; Uekermann et al., 2008b; Wang et al., 2008) and are consistent with the notion that depressed individuals have difficulties detaching from an egocentric viewpoint in order to adopt the perspective of another (Vogeley et al., 2001). These results are also consistent with recent studies conducted in bipolar disorder, documenting reduced perspective taking ability in individuals in varying states of illness (Cusi et al., 2010; McKinnon et al., 2010), including euthymia (Shamay-Tsoory et al., 2009). We suspect that impaired perspective taking ability in our sample may be mediated by deficits in executive functioning and other cognitive processes, including cognitive flexibility, closely associated with perspective taking ability (e.g., Eslinger, 1998; McKinnon and Moscovitch, 2007) and reported routinely in patients with MDD (e.g., Porter et al., 2003). Future studies, however, are required to test the relation between empathic ability and cognitive functioning in MDD, through, for example, the utilization of neuropsychological test batteries along with measures of empathic responding.

Table 2

Interpersonal Reactivity Index and Toronto Empathy Questionnaire scores by diagnostic group.

Empathy scales	Controls	MDD Patients	Results	Effect size (partial eta-squared)
TEQ	67.1(6.3)*	61.4(7.2)*	$F(1, 38) = 6.96$, $P < 0.05$	0.16
IRI perspective taking	21.4(4.3)*	17.8(3.8)*	$F(1, 38) = 7.65$, $P < 0.05$	0.17
IRI empathic concern	22.8(3.7)*	20.4(3.6)*	$F(1, 38) = 4.86$, $P < 0.05$	0.11
IRI fantasy	14.4(5.9)	15.1(5.0)	$F(1, 38) = 0.12$, $P > 0.05$	0.003
IRI personal distress	8.4(6.2)	11.4(4.5)	$F(1, 38) = 2.86$, $P > 0.05$	0.07

Values are *n* or mean (standard deviation).

Abbreviations: IRI, Interpersonal Reactivity Index; MDD, major depressive disorder group; TEQ, Toronto Empathy Questionnaire.

* Significantly different from control group at $P < 0.05$.

Our results also provide early evidence that individuals with MDD report less feelings of care and concern in response to someone else's emotional experience; patients reported lower levels of empathic concern on the Empathic Concern subscale of the IRI. Individuals with MDD also reported reduced empathic responding on the TEQ. These findings are consistent with the notion that depression is characterized by a preoccupation with the self and negative ruminations (Beck, 1967; Raes et al., 2006), that is enhanced with more severe illness (Joormann and Gotlib, 2010). These findings are, however, in contrast with previous reports of intact Empathic Concern in a sample of depressed inpatients, where O'Connor et al. (2002) reported elevated levels of personal distress, but not reduced empathic concern, in response to others' concerns in a sample comprised of acutely ill inpatients with MDD. Taken together with the current findings, we suggest that levels of empathic concern may fluctuate with illness state such that a variable profile of empathic responding emerges across active, sub-syndromal and euthymic states of depressive illness. Notably, individuals with bipolar disorder also show differing levels of empathic responding across active and euthymic illness states (Shamay-Tsoory et al., 2009; Cusi et al., 2010), suggesting that alterations in empathic responding in patients with mood disorders may represent a state, rather than trait, marker of illness.

As reviewed, the literature concerning social cognitive performance in patients with MDD is conflicting. Consistent with these findings, the results of this study provide evidence of both impaired and intact empathic capacity in MDD. Although patients with MDD reported reduced levels of care and concern for others (IRI Empathic Concern scale, TEQ), they reported similar levels of distress in response to difficult interpersonal situations (IRI Personal Distress scale) as controls. Patients with MDD also rated themselves comparably to controls in identifying with fictional characters found in books and movies (Fantasy subscale), a finding in line with previous studies conducted in depressed (O'Connor et al., 2002) and bipolar (Shamay-Tsoory et al., 2009; Cusi et al., 2010) samples. Baron-Cohen and Wheelwright (2004) have suggested that the Fantasy subscale of the Interpersonal Reactivity Index contains items that measure constructs broader than empathy, including imagination. On balance, our finding of impairments in specific aspects of empathic responding captured by the IRI, and preservation in others, is consistent with the notion that empathy is multidimensional in nature (Davis, 1994).

Empathic responding has been shown to rely on a complex network of neural regions that serve diverse cognitive (e.g., dorsolateral prefrontal cortex), affective (e.g., orbitofrontal and medial frontal; amygdala; subgenual cingulate) and memory functions (e.g., anterior and posterior cingulate, temporal poles; Eslinger, 1998; Farrow et al., 2001; McKinnon et al., 2007; Zahn et al., 2009). Critically, many of the same neural regions thought to mediate the cognitive and affective processes necessary for empathic responding have been implicated in patients with MDD, showing altered metabolic functioning and/or structural abnormalities (see Price and Drevets, 2010 for a recent review). For example, the medial prefrontal cortex, a region implicated in cognitive perspective taking (Eslinger, 1998; Shamay-Tsoory et al., 2009) and theory of mind (Gallagher and Frith, 2003; Mar, 2011), shows hyperactivity (Biver et al., 1994; Nofzinger et al., 2005) and reduced tissue volume (Lai et al., 2000; Lacerda et al., 2004) in patients with MDD. The dorsolateral prefrontal cortex (DLPFC), shows tissue volume loss (Coffey et al., 1993; Konarski et al., 2008; Brooks et al., 2009) and hypometabolism in patients with MDD (Biver et al., 1994; Dunn et al., 2002; Davidson et al., 2003) and may contribute to reductions in cognitive flexibility and the generation of ideas also thought requisite to empathic responding (Eslinger, 1998; Rankin et al., 2005). Moreover, tissue volume loss (Sheline et al., 1998; Caetano et al., 2004; Hastings et al., 2004) and hypermetabolism (Drevets, 2000; Sheline et al., 2001) has been reported in the amygdala, a region involved in modulating attention to emotionally salient stimuli (thought to be necessary to understand

and respond to the feeling states of others). Finally, the subgenual cingulate cortex, a region implicated in the generation of negative affect (thought to be necessary for generating emotional responses to social situations and the feelings of others), shows abnormally elevated activity in patients with MDD (Drevets and Raichle, 1992; Drevets et al., 2008). Impairments in empathic concern in our sample may be further mediated by deficits in emotion recognition (e.g., amygdala) and the generation (e.g., subgenual cingulate) and regulation of emotional responses (e.g., orbitofrontal cortex) also found in this disorder (see Phillips et al., 2003 for a review). On balance, we speculate that empathy draws on a host of cognitive and affective processing resources and the locus of deficits in this and other social cognitive domains is likely to be multi-faceted. Future studies, however, are awaited to explore this hypothesis and to identify specifically the neural underpinnings of social cognitive performance deficits in MDD.

Patients in our sample with a higher burden of illness (i.e., greater number of depressive episodes) were more likely to have reduced IRI Perspective Taking scores, suggesting a gradual deterioration of this social cognitive ability with illness progression or, alternatively, that overall reductions in perspective taking ability among patients with MDD contribute to a more severe course of illness. This finding is similar to that of a recent study (Schenkel et al., 2008) that found an extended course of illness also predicted theory of mind impairment in patients with acute and sub-syndromal bipolar disorder; it is notable, however, that bipolar disorder involves a different course of illness than MDD and these findings cannot be directly linked. Alterations in cognitive functioning, including memory and executive functioning, have also been shown to worsen with disease progression in patients with recurrent unipolar and bipolar illness (van Gorp et al., 1998; Lebowitz et al., 2001; MacQueen et al., 2002; but see Nehra et al., 2006; Pavuluri et al., 2006 for conflicting findings). The ability to adopt the perspective of another is important for guiding successful social behavior (Baron-Cohen and Wheelwright, 2004). Compromised perspective taking skills may lead to the inappropriate interpretation of social cues, resulting in changes in mood and interpersonal functioning, and may represent a risk factor for having a more deteriorative course of illness. The cross-sectional nature of the study, however, limits our ability to determine if deficits in perspective taking and associated cognitive processes contribute to the development of mood symptoms or conversely, if an increased illness burden negatively impacts cognitive functioning and perspective taking. Specifically, prospective, longitudinal studies are needed to explore how empathic responding changes over the course of illness in individuals with major depressive disorder.

Neither cognitive nor affective empathy scores were significantly associated with mood state at the time of testing, a result consistent with prior research showing that some aspects of social cognitive performance (e.g., theory of mind, facial emotion recognition) are independent of symptom severity in MDD (e.g., Leppänen et al., 2004; Lee et al., 2005). Other investigations (O'Connor et al., 2002; Donges et al., 2005), however, have reported significant negative associations between altered empathic responding and level of depression. The discrepant finding in the present study may be due, in part, to the limited range of HAM-D scores in our sample, and the inclusion of sub-syndromal patients. Further studies with larger sample sizes and participants in varying mood states, including acute depression and euthymia, are required to determine the association between empathic responding and symptom severity.

Our preliminary study provides the first evidence of impaired cognitive and affective empathic abilities in a sample of MDD outpatients and warrants further investigations of empathic responding in this patient population. Future work would benefit from including objective measures of empathic responding given that self-report measures show inherent biases (Baldwin, 2000). Further, this study provides the first evidence that an impaired ability to adopt another

person's viewpoint is related to past burden of illness in MDD; the directionality of this relation has yet to be established. Future studies of empathic responding that follow patients longitudinally in active and in euthymic illness states, and that examine performance in clinically unaffected first-degree relatives of patients with MDD are needed to determine if alterations in this social cognitive ability represent a trait characteristic of MDD. Additional work is required to characterize the relation between social cognitive performance and social functioning, where reduced levels of empathic responding were not associated with poor psychosocial functioning in our sample, likely due to the small sample size. Given that intact empathic skills are essential for higher social functioning (Baron-Cohen and Wheelwright, 2004; Spreng et al., 2009; Cusi et al., 2010), the non-adaptive nature of empathy deficits in MDD is at odds with recent claims that depression increases analytic skills in a manner that is evolutionarily "adaptive" (Andrews and Thomson, 2009). Future research is required to determine whether these empathy deficits have adaptive value (e.g., providing protection from further emotional arousal under stressful or dangerous situations). Finally, future studies utilizing structural and functional neuroimaging methods to examine the neural substrates of social cognition in MDD will provide significant information concerning the putative neural mechanisms underlying social dysfunction in this illness.

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