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Self-reported empathy in adults with autism, early psychosis, and social anxiety disorder

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ABSTRACT

The Empathy Quotient (EQ) self-report questionnaire is used to measure empathy in individuals with clinical conditions that have been associated with social impairments. In this study, older teens and adults with autism spectrum disorder (ASD; $N = 60$), early psychosis (EP; $N = 51$) and social anxiety disorder (SAD; $N = 71$) and neurotypical controls (NT; $N = 26$) were compared on the cognitive empathy, emotional reactivity and social skills sub-scales of the Empathy Quotient (EQ) measure. All three clinical groups reported lower cognitive empathy than NT controls, and the ASD group reported lower cognitive empathy than EP and SAD groups. The ASD group reported lower emotional reactivity than the SAD group. All three clinical groups reported lower social skills that NT controls. The poor self-rated empathy for the ASD and EP groups generally reflects previous research that found individuals with these conditions perform relatively poorly on certain objective measures of empathy. However, the poor self-rated cognitive empathy and social skills for the SAD group conflicts with previous research that has found that SAD groups perform well on objective measures of empathy. This suggests that both EQ and objective measures should be used to fully assess empathy in clinical groups.

1. Introduction

The ability to understand other people's mental states has long been considered important for health and social functioning. Impairments in this capacity are linked to a number of disorders, such as autism spectrum disorder (ASD) and psychotic disorders, and are believed to contribute to their social impairments (American Psychiatric Association, 2013). The Empathy Quotient (EQ) has been used as a brief self-report screen to detect impairments in empathy (Baron-Cohen and Wheelwright, 2004). Empathy as assessed by the EQ has been defined as the ability to "tune into how someone else is feeling, or what they might be thinking. Empathy allows us to understand the intentions of others, predict their behavior, and experience an emotion triggered by their emotion" (Baron-Cohen and Wheelwright, 2004).

In its original form, the EQ questionnaire consisted of 40 questions aimed at assessing empathy (e.g., "I am quick to spot when someone in a group is feeling awkward or uncomfortable"), and 20 filler/control items, with responses to be made on a 4 point rating scale from "strongly agree" to "strongly disagree" (Baron-Cohen and Wheelwright, 2004). Shorter forms of the EQ questionnaire were later developed, including a 28 item version derived from items identified as most relevant using a principal components analysis (Lawrence et al., 2004), and a 15 item form derived from a factor analysis (Muncer and Ling, 2006). The statistical modelling for both of these shorter forms of the EQ indicated that individual items loaded onto three factors, which could be used to calculate three sub-scale scores on the questionnaire representing three aspects of empathy: cognitive empathy, emotional reactivity, and social skills.

The Cognitive Empathy sub-scale of the EQ measures the capacity to work out what another person is likely to be thinking, the skills also known as emotion recognition and theory of mind (e.g., "I can easily work out what another person might want to talk about"). The Emotional Reactivity (or Emotional Empathy) sub-scale measures the ability to recognise and respond emotionally to the affective states of other people (e.g., "Seeing other people cry does not really upset me"). The Social Skill sub-scale measures the ability to maintain relationships and to understand what is socially appropriate behaviour in interactions with others (e.g., "I find it hard to know what to do in a social situation") (Lawrence et al., 2004; Muncer and Ling, 2006).

It has been hypothesised that the difficulties that people with

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certain clinical conditions experience in social interactions may be connected to impairments in empathy. In particular, many of the difficulties experienced by those with ASD have been linked to difficulties with empathy (American Psychiatric Association, 2013; Baron-Cohen and Wheelwright, 2004; Pepper et al., 2018). To illustrate, the original developers of the EQ measure used it to demonstrate that people with ASD reported significantly less empathy than neurotypical (NT) controls, and that the total EQ was significantly negatively correlated with the Autism Quotient (AQ), a self-report questionnaire measure of ASD characteristics (Baron-Cohen and Wheelwright, 2004). Other studies have confirmed the reduced total EQ results for ASD cohorts compared to NT controls (Berthoz et al., 2008; Pepper et al., 2018; Sucksmith et al., 2013). However, there remains a question over whether individuals with ASD have difficulties with all forms of empathy. A number of studies using both objective measures and self-rating measures apart from the EQ have indicated that those with ASD or autistic traits have impaired cognitive empathy (Dziobek et al., 2008; Lockwood et al., 2013; Mazza et al., 2014; Rogers et al., 2007). The picture remains more mixed for emotional empathy, with some studies finding no significant impairment in those with ASD or autistic traits (Dziobek et al., 2008; Lockwood et al., 2013; Rogers et al., 2007), while others have found some degree of impaired emotional empathy (Mazza et al., 2014; Nuske et al., 2013).

The EQ measure has also been used to study the role of empathy impairments in psychosis. The findings for these cohorts have been less consistent than those for ASD groups. One study found that adults with schizophrenia did not have a significantly different total EQ (60 item) than a NT control group when they rated themselves, but they had a significantly lower total EQ than NT controls when the EQ was rated by a relative (Bora et al., 2008). In another study, total EQ and EQ Social Skills sub-scale were found to have modest but significant positive correlations with the Reading to Mind in the Eyes test, an objective test of emotion recognition, in participants with depersonalisation disorder and NT controls. (Lawrence et al., 2004). A further study found no significant difference in total EQ between groups of adults with high and low levels of schizotypy (Aghvinian and Sergi, 2018).

The role of empathy in disorders characterised by social avoidance, such as social anxiety disorder (SAD), has been less investigated. It is particularly important to understand how social anxiety might influence self-reports on such measures because social anxiety is also highly comorbid with both psychosis and ASD presentations and is likely to result in negative self-representations of social performance (Lai et al., 2014; Pontillo et al., 2017). Recent research has suggested that individuals reporting high levels of social anxiety may self-report relatively low levels of EQ despite their objective social cognition performance scoring at typical levels (Pepper et al., 2018), implying that individuals with SAD may perceive their social cognition capabilities to be less than they actually are. This original analysis did not, however, consider the three sub-scales of the EQ relating to reported cognitive and emotional empathy and social skills performance.

The aim of the present study is to investigate self-reported empathy as rated on the EQ sub-scales between participants meeting criteria for ASD, SAD and early psychosis (EP), and to compare this report against a NT control group. For the Cognitive Empathy sub-scale, it is expected that ASD and EP participants will rate lower than the SAD and NT groups, because previous research using objective measures of the social cognition skills that facilitate cognitive empathy, such as emotion recognition, has indicated that people with ASD and EP have difficulty with these skills, while those with SAD and NT do not (Pepper et al., 2018). We make no specific predictions about the relative ratings between the groups for the Emotional Reactivity sub-scale, because previous research on emotional empathy in clinical groups has produced mixed results or been lacking. Finally, we predict that all three clinical groups may rate themselves lower than the NT group on the Social Skill sub-scale, consistent with their social phenotypes. In the case of ASD and EP, difficulties in communication and social interactions are part of the diagnostic criteria of those conditions (American Psychiatric Association, 2013). In the case of SAD, anxiety about their own adequacy in social interactions is part of the diagnostic criteria of the condition (American Psychiatric Association, 2013), and some previous research has indicated that individuals with SAD may also objectively be lacking in social skills in some situations (Halls et al., 2015; Voncken and Bogels, 2008).

2. Methods

2.1. Participants

Ethics approval for this study (Project number: 2013/352) was obtained from the University of Sydney Ethics Committee, and was carried out in accordance with the Declaration of Helsinki. Prior to inclusion in this study, written informed consent was obtained from each participant after the research procedures had been explained. A total of 208 participants were recruited into the study (Age: $M = 23$ years, range 16–46 years, with 89% in range 16–30 years; SAD $N = 70$, ASD $N = 60$; EP $N = 51$; NT $N = 26$).

Participants for the clinical groups (ASD, SAD and EP) were recruited from a cohort of older teens and adults who presented sequentially for treatment and/or social skills development at the Autism Clinic for Translational Research (ACTr) and *Headspace* Brain and Mind Centre clinics, with which the authors are affiliated. These participants were assessed by research qualified clinicians at the ACTr, and those in the clinical groups were diagnosed based on information gained from clinical case files and standardised diagnostic instruments. For participants to be assigned to the SAD diagnostic group, they had to meet criteria for SAD on the Anxiety Diagnostic Interview Schedule (ADIS-IV/V) (Brown and Barlow, 2014; Brown et al., 1994; Pepper et al., 2018). (Participants who showed evidence of ASD-like symptoms at the time of referral or clinical interview were also assessed with the ADOS.) Participants were assigned to the ASD diagnostic group based on a clinical interview that assessed DSM-V criteria and meeting the clinical cut-off on the Autism Diagnostic Observation Schedule – 2nd edition (ADOS-2) (Lord et al., 2012). Participants intended for the SAD and ASD groups were also screened for psychotic symptoms, and any reporting psychotic symptoms were excluded from those groups. Participants for the EP diagnostic group were assessed using the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I) (First et al., 1995). Neurotypical (NT) control participants were recruited by advertising on university websites.

Estimated full scale IQ was calculated using the Wechsler Test of Adult Reading (WTAR) (Wechsler, 2001) for the NT, ASD and SAD groups, and the two subtest version of the Wechsler Abbreviated Scale of Intelligence (WASI) (Wechsler, 1999) for the EP group, which was assessed under a slightly different protocol. Prospective participants were screened and excluded from the study if the IQ test indicated an intellectual disability (IQ < 70), or if they reported a neurological condition or current substance dependence. Potential neurotypical control participants were excluded if they reported a past or current mental health diagnosis, or if they responded positively to questions about psychosis symptoms at the recruitment interview, or if their scores on the Depression, Anxiety and Stress Scale-(DASS-21) (Lovibond and Lovibond, 1995), the Social Interaction Anxiety Scale (SIAS) (Heimberg et al., 1992), or short-form Autism Quotient (AQ-10) (Allison et al., 2012) indicated the presence of a clinical condition. Participants were also asked to report any current psychotropic medication use.

2.2. Measures

The 15-item abbreviated version of the Cambridge Behaviour Scale Empathy Quotient (EQ) questionnaire was completed by all participants. A self-report measure of social cognition, this questionnaire asks

participants to rate their own social cognition abilities relating to social situations or relationships (Baron-Cohen and Wheelwright, 2004; Muncer and Ling, 2006). From the answers a Total Empathy (EQ) score was calculated (maximum score = 30), with higher scores indicating a higher level of self-perceived general empathy. Three sub-scale scores were also calculated (maximum score = 10), representing Cognitive Empathy (*i.e.*, working out what others are thinking), Emotional Reactivity (*i.e.*, responding emotionally to the feelings of others), and Social Skills (*i.e.*, understanding and demonstrating socially appropriate behaviour). The EQ, including the three sub-scales, has been demonstrated to be a valid and reliable measure of empathy and social skill (Baron-Cohen and Wheelwright, 2004; Lawrence et al., 2004; Muncer and Ling, 2006).

2.3. Data analysis

Data relating to the participants' demographic characteristics, IQ and EQ questionnaire responses were statistically analysed using the IBM SPSS Statistics Version 24 analysis program. Total and sub-scale scores for the EQ questionnaire were calculated according to the standard scoring algorithms for the 15-item abbreviated Cambridge Behaviour Scale Abbreviated Empathy Quotient (EQ) (Muncer and Ling, 2006).

In order to test for differences between groups on demographic characteristics, a Pearson's chi-square test was performed on the sex by group data, and univariate analyses of variance (ANOVA, Welch's *F*) were performed on age and IQ by group data. A multivariate analysis of variance (MANOVA, Pillai's Trace) was carried out to examine for differences between the clinical and NT groups on the EQ sub-scale measures. The ANOVA and MANOVA analyses were followed by Games-Howell post-hoc comparison tests with Bonferroni corrections to take into account unequal sample sizes and unequal variances. Cohen's *d* effect sizes are reported for each pairwise comparison, whereby 0.2 represents a small effect, 0.5 a medium effect, and 0.8 a large effect (Cohen, 1988). A multivariate analysis of covariance (MANCOVA) with IQ as a covariate was also carried out between the clinical and NT groups. The analyses were also repeated with overall medication status, and antidepressant and antipsychotic use separately, as additional independent variables. A post-hoc calculation of power for the MANOVA analysis indicated that the total sample size ($n = 208$) was sufficient to achieve a power greater than 0.99 (Faul et al., 2007).

3. Results

3.1. Demographics

Results for demographic characteristics are presented in Table 1. There were no significant group differences present for sex or for age. Although all groups had IQs within the normal range, there was a significant difference in mean IQs between groups. Post-hoc comparisons showed that both the SAD and NT groups had slightly higher mean IQs than the EP group, and the SAD group had slightly higher mean IQ than the ASD group.

3.2. Empathy Quotient (EQ)

The descriptive statistics and results of the MANOVA analysis for the EQ results are summarised in Table 2. The overall multivariate MANOVA result for EQ sub-scales was significant (Pillai's Trace: $V = 0.406$), indicating that there was a difference in EQ generally between the four groups. In addition, follow-up univariate analyses of variance and post-hoc comparisons for the EQ sub-scales revealed significant differences between groups for all three measures. For the Cognitive Empathy sub-scale, the ASD group reported significantly more impairment than all the other groups, while the NT group reported significantly less impairment than all the other groups. The SAD and EP groups were not significantly different from each other on this sub-scale. For the Emotional Reactivity sub-scale, the SAD group reported significantly less impairment than the ASD group. For the Social Skill sub-scale, the ASD, EP and SAD groups all reported significantly greater impairment than the NT control group, but there was no significant difference in reported impairment between the three clinical groups. The pattern of EQ sub-scale results across the four diagnostic groups is shown in Fig. 1. Because there was a significant difference in IQ between the groups, the multivariate analysis of variance of the EQ scores was repeated with IQ as covariate. The results of this MANCOVA analysis remained the same in terms of group differences and were similar in magnitude to the MANOVA results when this covariate was included.

3.3. Psychotropic medication use

Data on psychotropic medication use are summarised in Table 3. There were no statistically significant interaction effects found between medication status and diagnostic group in the MANOVA analysis.

4. Discussion

The results of this study suggest that individuals with disorders associated with social impairment, including ASD, EP and SAD, all report empathy difficulties as assessed by the EQ and this varied across diagnostic groups. All three clinical groups rated themselves as having difficulty with Cognitive Empathy compared to NT controls. The ASD participants reported significantly more difficulty than either SAD or EP participants. On the other hand, SAD participants had the highest average ratings for Emotional Reactivity out of all the groups and had significantly higher scores on this sub-scale than the ASD participants, although they were not significantly different from the EP and NT groups. As expected, all three clinical groups rated themselves as having poor Social Skills in comparison with the NT groups and,

Table 1
Demographic characteristics of participants with a primary diagnosis of autism spectrum disorder (ASD), early psychosis (EP), social anxiety disorder (SAD), and neurotypical control (NT) participants.

Primary diagnosis	ASD_agroup		EP_bgroup		SAD_cgroup		NT_dgroup		Statistical analysis						
Sex	*N*	%	*N*	%	*N*	%	*N*	%	Pearson Chi-Square						
Male	39	65.0	36	70.6	38	53.5	18	69.2	$\chi^2_{(3,\ N\ =\ 208)} = 4.53$, ns						
Demographic characteristics	Mean	(SD)	Mean	(SD)	Mean	(SD)	Mean	(SD)	ANOVA	Post-hoc pairwise comparisons					
N	60		51		71		26			a *vs* b	a *vs* c	a *vs* d	b *vs* c	b *vs* d	c *vs* d
Age (years)	23.67	(7.20)	21.75	(4.38)	22.62	(6.03)	24.96	(6.63)	$F_{(3,\ 86.4)} = 2.14$	ns	ns	ns	ns	ns	ns
IQ	107.20	(8.85)	102.24	(14.10)	111.45	(6.86)	110.85	(6.76)	$F_{(3,\ 87.9)} = 8.01$***	ns	*	ns	***	**	ns

* $p < .05$.
** $p < .01$.
*** $p < .001$.
ns = not significant.

Table 2
Descriptive statistics (mean, SD, *N*), and significance tests (*F*) comparing social cognition measures between participants with autism spectrum disorder (ASD), early psychosis (EP), social anxiety disorder (SAD), and neurotypical control participants (NT).

Primary diagnosis	ASD_agroup (N = 60)		EP_bgroup (N = 51)		SAD_cgroup (N = 71)		NT_dgroup (N = 26)		MANOVA	Post-hoc pairwise comparisons (and effect sizes)					
										a *vs* b	a *vs* c	a *vs* d	b *vs* c	b *vs* d	c *vs* d
	Mean	(SD)	Mean	(SD)	Mean	(SD)	Mean	(SD)							
EQ overall (multivariate):									$F_{(9, 612)} = 10.65^{***}$						
EQ sub-scales (univariate):															
Cognitive Empathy	2.80	(2.42)	4.25	(2.63)	4.35	(2.38)	6.88	(2.29)	$F_{(3, 204)} = 17.13^{***}$	*(0.86)	**(0.95)	***(2.03)	ns (0.04)	**(1.07)	**(1.08)
Emotional Reactivity	4.68	(2.62)	5.00	(2.15)	6.03	(2.20)	5.62	(2.21)	$F_{(3, 204)} = 4.22^{**}$	ns (0.13)	*(0.56)	ns (0.39)	ns (0.47)	ns (0.28)	ns (0.19)
Social Skills	1.86	(1.83)	2.92	(2.62)	2.40	(2.11)	6.58	(2.85)	$F_{(3, 204)} = 27.97^{***}$	ns (0.47)	ns (0.27)	***(1.97)	ns (0.22)	***(1.34)	***(1.67)
EQ Totals	9.33	(4.73)	12.17	(5.41)	12.79	(4.62)	19.08	(5.73)							

* $p < .05$.
** $p < .01$.
*** $p < .001$.
ns = not significant. *Note:* Effect sizes are reported as Cohen's *d*.

suprisingly, there was no difference between the clinical groups on this scale. We will now turn to examine the pattern of EQ sub-scale ratings for each clinical group.

It is consistent with theoretical models that people with ASD self-rated their performance as poor on all three EQ sub-scales, as these reflect the impairments of social cognition and social skill which are the core diagnostic features of ASD (American Psychiatric Association, 2013). Previous studies using objective tests of social cognition have found that ASD participants overall perform worse at both basic emotion recognition and some complex theory of mind tasks (Pepper et al., 2018; Rutherford et al., 2002; Sucksmith et al., 2013), which corresponds with the low self-rating of Cognitive Empathy by ASD participants in the current study. Previous studies have also shown impairments in social skills in researcher-rated role-play assessments (Morrison et al., 2017), which agrees with the poor self-rated Social Skills in the present ASD group.

Emotional Reactivity is relatively difficult to measure objectively using behavioural responses, but some studies have assessed observable behavioural responses such as concerned facial expressions or length of gaze directed at a person in apparent distress (Nuske et al., 2013). These studies have reported mixed results with ASD participants. Some studies report low emotional reactivity (or emotional empathy), and others report comparable reactivity/empathy with NT cohorts (Dziobek et al., 2008; Lockwood et al., 2013; Mazza et al., 2014; Nuske et al., 2013; Rogers et al., 2007) . Other studies have used functional magnetic resonance imaging (fMRI) and skin conductance measures to compare physiological brain and autonomic responses between ASD and NT cohorts to stimuli that are intended to arouse emotional empathy, and these too these have produced mixed results. In some instances, people with ASD have shown similar brain arousal to NT cohorts in response to images of pained faces but less response to images of injured limbs (Lassalle et al., 2018), while in other instances people with ASD have shown increased cortical and autonomic arousal compared to NT controls to similar stimuli (Gu et al., 2015). These results suggest a complex picture for emotional empathy in ASD when it is objectively measured, with ASD cohorts not necessarily performing more poorly than NT comparators. Turning to self-rated measures of emotional empathy, it should be noted that the developers of the EQ probed their participants with ASD in clinical interviews for the reasons why they gave themselves poor EQ ratings. They found that participants with ASD often reported that they had a desire to respond to others in an emotionally appropriate way, but their difficulties with reading others' thoughts and choosing appropriate ways to interact with others interfered with their ability to do so (Baron-Cohen and Wheelwright, 2004). This suggests that the poor self-perceived Emotional Reactivity found in the present study may be at least partially a consequence of impaired Cognitive Empathy and Social Skill.

The EP participants also rated themselves relatively poorly on Cognitive Empathy and Social Skills, although their self-rating of Cognitive Empathy was not as low as that of the ASD group. Previous studies have found that EP cohorts have some difficulty on objective tests of emotion recognition (Addington et al., 2008; Guastella et al., 2013; Pepper et al., 2018), theory of mind (Chung et al., 2008), and social skills (Morrison et al., 2017). Like the SAD group, the EP group's self-rated Emotional Reactivity was relatively high and not significantly different from that of the NT group.

The study also provides evidence that social anxiety is associated with reduced self-ratings on the EQ measures. In the case of the SAD participants, it is somewhat surprising to find that people with SAD rated themselves relatively poorly on Cognitive Empathy, as previous research has shown that these participants perform at typical levels on objective tests of emotion recognition and theory of mind (Pepper et al., 2018; Plana et al., 2014). In the case of people with SAD, who objectively appear quite capable of cognitive empathy, there is a mismatch between their self-perceived and actual capability in this area. One possible explanation for their poor self-rating for Cognitive Empathy

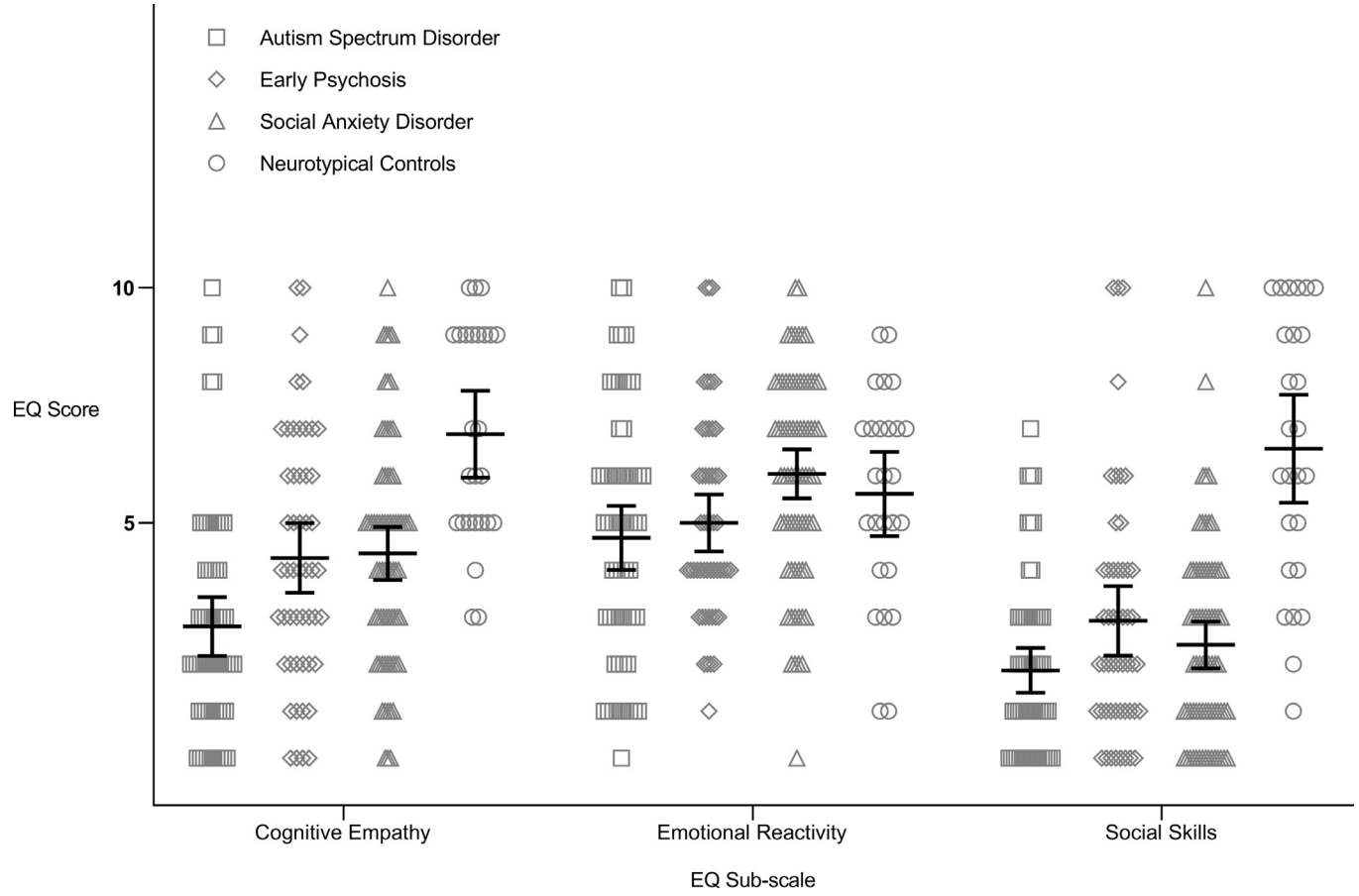

Fig. 1. EQ sub-scale scores across diagnostic groups.
The patterns of EQ scores (means with 95% confidence interval bars) for the cognitive empathy, emotional reactivity and social skills sub-scales across diagnostic groups: autism spectrum disorder (ASD), early psychosis (EP), social anxiety disorder (SAD) and neurotypical controls (NT).

Table 3
Summary of psychotropic medication use for diagnostic groups. Figures represent the number (and percentage) of participants taking each type of medication in each of the diagnostic groups.

Medication type	Autism spectrum disorder (N = 60)		Early psychosis (N = 51)		Social anxiety disorder (N = 71)	
Antidepressants	26	(43%)	14	(28%)	31	(44%)
Sedatives/hypnotics	1	(2%)	0	(0%)	1	(1%)
Mood stabilisers	4	(7%)	9	(18%)	4	(6%)
Antipsychotics	16	(27%)	43	(84%)	8	(11%)
Benzodiazepines	1	(2%)	2	(4%)	3	(4%)
Stimulants	11	(18%)	0	(0%)	2	(3%)
Anticonvulsants	1	(2%)	0	(0%)	2	(3%)
All medications	33	(55%)	46	(92%)	35	(49%)

may lie in a difficulty in applying their cognitive empathy skills fully in real social situations. For example, the high levels of skill in facial emotion recognition demonstrated by this cohort while looking at photographs of faces in laboratory conditions (Pepper et al., 2018) may not translate to real social situations if the individual is too shy or anxious to look at the people that they are interacting with (Chen et al., 2015). Less surprisingly, their exaggerated negative view of their own performance appears to translate into poor ratings on the Social Skills sub-domain (Hofmann, 2007), although this latter result may also reflect some degree of objectively impaired communication and social skills (Halls et al., 2015; Kristensen and Torgersen, 2008; Voncken and Bogels, 2008). On the other hand, they rate themselves highly on Emotional Reactivity, so they clearly perceive themselves as responding emotionally to others in an appropriate way.

The EQ is a self-report measure and reflects the test-taker's perception of their own capacity for empathy, which may or may not correspond to their objective performance. While the measure was originally intended to assess social impairments as they relate to ASD and EP, the results of this study indicate that reduced performance on the EQ is likely to result from a mixture of real social-cognitive impairments and elevated social anxiety levels, which may exaggerate negative self-appraisals of performance and increase social avoidance. Adding objective tests of these mechanisms to an assessment battery is likely to assist teasing apart these factors.

The present study had a number of limitations. The clinical participants were all actively seeking help, so our findings may not be applicable to populations that do not attend mental health services. Our participants also showed no intellectual disabilities, so the findings of this study may not apply to individuals with reduced intellectual capacities. We also note that ASD and EP groups were not routinely assessed for SAD and were not excluded if they had comorbid SAD. Excluding participants with ASD and EP who also had SAD would not be feasible given the high levels of diagnostic overlap and comorbidity. In contrast, we did exclude from the SAD group participants who reported or presented with any signs that might be associated with ASD or EP. Future investigation may be needed to explore reports of participants with ASD and EP who do not also show comorbid SAD. In addition, the EQ as a measure of empathy focusses on the ability to identify and respond to the thoughts and feelings of others without taking into account the ability to identify one's own emotions. Given that there is evidence that alexithymia plays a role in social interaction deficits, especially for ASD (Bird and Cook, 2013), future research should include measures of the capacity to identify one's own emotions.

Furthermore, a considerable number of the clinical group participants were taking psychotropic medications. Although we did not find significant interactions between self-rated empathy and medication status, the effects of medication on empathy should be considered in more detail in future studies. Finally, the NT sample was considerably smaller than the clinical samples, although the statistical power was adequate.

In conclusion, this is the first study to compare self-reports of cognitive empathy, emotional reactivity and social skills across three groups associated with social impairment and meeting diagnostic criteria for ASD, EP and SAD. The study demonstrates that all clinical groups report reduced performance, although the severity and pattern of reported difficulty is most apparent for those diagnosed with ASD. The results highlight the need for adjunctive objective measures to complement self-report measures of empathy and suggest further investigations to further understand contributions of cognitive cognition, social skill, and social anxiety on self-reported ratings of empathy.

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Declaration of Competing Interest

IH is a Commissioner in Australia's new National Mental Health Commission from 2012. He was a director of headspace: the national youth mental health foundation until January 2012. He was previously the chief executive officer (till 2003) and clinical adviser (till 2006) of beyondblue, an Australian National Depression Initiative. He is the Co-Director, Health and Policy at the Brain and Mind Centre that operates two early-intervention youth services under contract to headspace. He has led a range of community-based and pharmaceutical industry-supported depression awareness and education and training programs. He has led projects for health professionals and the community supported by governmental, community agency and pharmaceutical industry partners (Wyeth, Eli Lily, Servier, Pfizer, AstraZeneca) for the identification and management of depression and anxiety. He has received honoraria for presentations of his own work at educational seminars supported by a number of non-government organisations and the pharmaceutical industry (including Servier, Pfizer, AstraZeneca and Eli Lilly). He is a member of the Medical Advisory Panel for Medibank Private and also a Board Member of Psychosis Australia Trust. He leads an investigator-initiated study of the effects of agomelatine on circadian parameters (supported in part by Servier) and has participated in a multicentre clinical trial of the effects of agomelatine on sleep architecture in depression and a Servier-supported study of major depression and sleep disturbance in primary care settings. The other authors declare no conflict of interest.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.psychres.2019.112604.

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