Received: 24 October 2019 | Revised: 31 May 2020 | Accepted: 24 June 2020

DOI: 10.1111/eip.13021

ORIGINAL ARTICLE

WILEY

Autistic traits in first-episode psychosis: Rates and association with 1-year recovery outcomes

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Funding information
National Medical Research Council, Grant/Award Number: Research Seed Funding (Pilot Study) at IMH/WH

Abstract

Aim: There is a growing appreciation that subthreshold but clinically elevated levels of autistic traits are clinically relevant. This study examined autistic traits in Singaporean patients with first-episode psychosis and their association with 1-year psychosis recovery.

Methods: The relationship between baseline patient characteristics, autistic traits (measured with autism screening questionnaires) and psychosis recovery outcomes at 1-year were examined in 180 adults in the Early Intervention Psychosis Programme in Singapore.

Results: Out of 180 participants, 50 (27.8%) had clinically elevated above screening-cut off levels of autistic traits on the self-reported 10-item Autism Spectrum Quotient and 8 (4.4%) on the staff-rated Autism Spectrum Disorder in Adults Screening Questionnaire. At baseline, those with more autistic traits were more likely to be unemployed, economically inactive (ie, students or homemakers); and to have diagnoses of mood disorder with psychotic features, brief psychotic disorder or psychotic disorder not otherwise specified as compared to schizophrenia spectrum and delusional disorder diagnoses. Although most participants showed improvements in their clinical outcomes at 1-year, those with higher autistic traits improved less in the Positive and Negative Syndrome Scale general psychopathology scale and in Global Assessment of Functioning symptomatology.

Conclusions: Autistic traits are common in those with first-episode psychosis and may be associated with poorer clinical outcomes. Validated screening tools should be developed in this population to support earlier reporting.

KEYWORDS

adult, autism spectrum disorder, psychotic disorders, schizophrenia, surveys and questionnaires

1 | INTRODUCTION

Autism spectrum disorder (ASD) is increasingly recognized as a complex and heterogeneous neurodevelopmental condition that exists on a continuum of severity (Constantino & Todd, 2003). Individuals with subthreshold but elevated levels of autistic traits have a similar socio-cognitive profile to those with ASD diagnoses, in terms of their patterns of perceptual processing,

decision-making and reduced prosociality (Skylark & Baron-Cohen, 2017). Even though these traits do not meet diagnostic threshold, the presence of higher levels of autistic traits are clinically relevant as adults in the general population with higher autistic traits have been reported to struggle more with difficulties in their lives, such as problems with personal adjustment and interpersonal relationships, lower self-esteem and higher levels of depression and anxiety (Kanne, Christ, & Reiersen, 2009; Lundström et al., 2011).

Elevated autistic traits are also common in populations with early psychosis, with reported rates of 7.8%-25.0% (Davidson, Greenwood, Stansfield, & Wright, 2013; Fraser et al., 2011; Upthegrove et al., 2018). A study that examined the impact of autistic traits on 99 individuals with early psychosis in the United Kingdom found that higher levels of autistic traits were associated with poorer quality of life, functioning and current psychotic symptoms (Chisholm et al., 2019). At present, there is still a dearth of research exploring autistic traits and early psychosis recovery, including a lack of studies in Asian populations. This study therefore aimed to measure the rates of autistic traits in a group of Singaporeans with early psychosis and to determine if having more autistic traits may contribute to poorer recovery from psychosis.

2 | METHODS

2.1 | Participants and recruitment

Participants were recruited from the clinics of the Early Psychosis Intervention Programme (EPIP) at the Institute of Mental Health, Singapore, the only state psychiatric hospital in the country, between January 2017 and July 2018. Patients accepted into the programme are 16-40 years old with first-episode psychotic disorders (defined as meeting the *Diagnostic and Statistical Manual of Mental Disorders*, Fourth Edition [*DSM-IV*] criteria for schizophrenia, schizophreniform disorder, schizoaffective disorder, delusional disorder, brief psychotic disorder, psychotic disorder not otherwise specified [NOS], or mood disorders with psychotic features). Each patient is assigned a case manager who provides intensive supportive counselling, psychoeducation and coordinates healthcare services for up to 3 years to ensure continuity of care through different phases of the patient's illness (Tang et al., 2016), after which patients are transferred to general psychiatric services for further management.

EPIP clinicians were provided with a fortnightly list of patients they would be seeing and they screened patients for eligibility for the present study based on the following inclusion criteria: age above 21 years old; enrolled into EPIP for at least 10 months (to allow their 1-year clinical outcomes to be captured for the purposes of this study); no active suicidal ideation or florid psychotic symptoms that would preclude their safe participation in this study. Eligible participants were approached by the study team for recruitment at the clinics based on convenience sampling.

2.2 | Measures and procedures

Upon study enrolment, the participants' level of autistic traits were measured using (a) the self-reported 10-item *Autism-Spectrum Quotient* (AQ-10; Allison, Auyeung, & Baron-Cohen, 2012; a condensed version of AQ-50, designed to screen for ASD in adults without intellectual impairments) and (b) the *Autism Spectrum Disorder in Adults Screening Questionnaire*, which was completed by case managers in consultation with the client's family members (ASDASQ; Nylander & Gillberg, 2001; a 10-item observer-rated tool screening for observable behaviours suggestive of ASD in adult psychiatric outpatients). Scores of ≥6 on the AQ-10 and ≥5 on the ASDASQ are indicative of clinically significant elevated levels of autistic traits. Autistic traits were measured at study enrolment only, as they were posited to be consistent throughout the individual's phase of illness, given findings by Matsuo et al. (2015) that autistic traits in patients with schizophrenia were stable regardless of their symptom severity.

To determine the association between autistic traits and clinical recovery, scores from the two questionnaires were examined in relation to the participants' clinical and demographic variables at baseline and after 1-year of enrolment into EPIP. Data were extracted from the EPIP database, an ongoing registry that captures information of all EPIP patients at set time-points across the 3 years patients were with EPIP, including at baseline and 1-year. Socio-demographic data collected using a semi-structured questionnaire included age, gender, ethnicity, marital status, highest education level and employment status (employed, unemployed and economically inactive, eg, students and homemakers). Clinical data collected at baseline enrolment into EPIP included the duration of untreated psychosis (DUP; operationalized as the time between onset of psychotic symptoms and when definitive diagnoses and treatment were established); psychiatric diagnoses (which were established using the *Structured Clinical Interviews for DSM-IV*; SCID-CV; First, Spitzer, Gibbon, & Williams, 1996); symptoms using the *Positive and Negative Syndrome Scale for schizophrenia* (PANSS; Kay, Fiszbein, & Opler, 1987, a standardized 30-item scale measuring the presence and severity of positive and negative psychotic symptoms and general psychopathology, with scores of 1 [“absent”] to 7 [“extreme”] for each item); and functioning using the *Global Assessment of Functioning Scale* (GAF; Piersma & Boes, 1997; a numeric scale (0-100) used to rate an individual's level of functioning based on their impairments in psychological, social and occupational functioning, with higher scores indicating better functioning and less symptom severity).

Clinical data collected after 1 year of EPIP enrolment included PANSS, GAF scores and employment status. We derived the following clinical outcomes of interest at 1-year:

a. changes in PANSS and GAF scores between baseline and after 1-year of enrolment into EPIP;
b. cross-sectional symptomatic remission (adapted from the remission criteria established by the Remission in Schizophrenia Working Group; Andreasen et al., 2005): defined by scores of “3 = mild” or less on all of the following eight items from PANSS: P1 Delusions,

TABLE 1 Socio-demographic and clinical characteristics of participants

Baseline (enrolment into EPIP) (n = 180)	Mean (*SD*) or N (%)*
Age, mean (*SD*), range	28.5 (5.5), 21.0-40.9
Gender	
Female	85 (47.2)
Male	95 (52.8)
Marital status	
Single	158 (87.8)
Married	17 (9.4)
Divorced/separated/widowed	5 (2.8)
Ethnicity	
Chinese	126 (70.0)
Malay	36 (20.0)
Indian	18 (10.0)
Highest education level	
Primary school and below	6 (3.3)
Secondary education	61 (33.9)
Tertiary education	113 (62.8)
Employment	
Employed	51 (28.3)
Unemployed	73 (40.6)
Economically inactive[a]	56 (31.1)
DSM-IV diagnosis	
Schizophrenia spectrum[b] and delusional disorder	120 (66.7)
Mood disorder with psychotic features	20 (11.1)
Brief psychotic disorder or psychotic disorder not otherwise specified	40 (22.2)
Duration of untreated psychosis in months	14.3 (23.6), median = 4.3
PANSS	
Total	80.2 (21.9)
Positive scale	21.4 (6.1)
Negative scale	17.7 (8.5)
General psychopathology scale	41.0 (12.0)
GAF	
Total	41.5 (11.7)
Symptomatology	41.8 (12.0)
Disability	43.7 (11.8)
One-year follow-up (n = 163)	Mean (*SD*)
PANSS	
Total	42.8 (13.3)
Positive scale	9.3 (3.3)
Negative scale	10.6 (5.7)
General psychopathology scale	22.9 (6.6)
GAF	
Total	70.8 (9.8)
Symptomatology	71.1 (9.9)
Disability	71.5 (9.6)

Abbreviations: GAF, Global Assessment of Functioning; PANSS, Positive and Negative Syndrome Scale.
[a]Economically inactive was defined as students and homemakers.
[b]Schizophrenia spectrum disorders include schizophrenia, schizophreniform disorder and schizoaffective disorder.
*Mean PANSS and GAF scores at 1-year were statistically significant different as compared to mean PANSS and GAF scores at baseline, with $P \leq .05$.

P2 Conceptual disorganization, P3 Hallucinatory behaviour, N1 Blunted affect, N4 Social withdrawal, N6 Lack of spontaneity/flow of conversation, G5 Mannerisms/posturing and G9 Unusual thought content (Bodén, Sundström, Lindström, & Lindström, 2009). The criterion of remission maintenance over 6 months was removed due to the lack of 6-month PANSS scores in our database; and

c. functional remission—operationalized as a GAF disability score of ≥61 with engagement in age-appropriate vocation (Verma, Subramaniam, Abdin, Poon, & Chong, 2012).

Ethical approval was granted by the NHG Domain Specific Review Board (DSRB 2016/00953). All participants gave their informed consent prior to their inclusion in the study.

2.3 | Power calculation

A study by Davidson et al. (2013) found that 11.2% of their participants with first-episode psychosis screened positive on the ASDASQ. We estimated using a single proportion formula that a sample size of 153 was required to replicate the findings from this earlier study with a power of 80% and alpha of 5%.

2.4 | Statistical analyses

The Statistical Package for Social Sciences (SPSS) version 23.0 was used. Multivariate analyses were performed to identify factors associated with higher AQ-10 scores at baseline. Multiple logistic and linear regression models[1] that were adjusted for potential confounding variables (eg, age, gender, DUP, baseline employment, diagnosis, etc.) examined the role of autistic traits in predicting clinical change at 1-year. Partial eta squared was used as a measure of effect size. All statistically significant differences were evaluated at the 0.05 level using two-sided tests.

3 | RESULTS

180 participants were recruited.[2] Table 1 shows their baseline socio-demographic and clinical characteristics. The mean (*SD*) age was 28.5 (5.5) years. The majority were male (52.8%), Chinese (70.0%), single (87.8%) and unemployed (40.6%); had tertiary education (62.8%); and had diagnoses of schizophrenia spectrum (schizophrenia, schizophreniform disorder and schizoaffective disorder) and delusional disorders (66.7%). Their mean (*SD*) and median DUP was 14.3 (23.6) and 4.3 months, respectively. Their mean (*SD*) PANSS and GAF total scores were 80.2 (21.9) and 41.5 (11.7) respectively. The participants had been with EPIP for a median of 14.7 (interquartile range = 11.5-25.1) months.

Out of the 180 participants, 50 (27.8%) scored ≥6 on AQ-10 and 8 (4.4%) scored ≥5 on ASDASQ. 5 (2.8%) participants had above cut-off scores on both AQ-10 and ASDASQ.

Complete 1-year follow-up data were available for 160 participants (88.8%); 20 participants had defaulted their follow-up. Baseline clinical and socio-demographic data as well as AQ-10 and ASDASQ scores were compared between those who did vs those who did not complete the 1-year follow-up. Those without 1-year follow up data were less likely to have tertiary education as their highest education

TABLE 2 Baseline variables predicting higher AQ-10 scores (n = 180)

Patient or psychosis related characteristics	β[a]	95% CI	*P* value	Partial eta squared
Age	0.05	−0.02 to 0.12	.15	0.01
Gender				
Female	Reference			
Male	0.43	−0.20 to 1.05	.18	0.01
Marital status				
Single	Reference			
Married	−0.13	−1.27 to 1.00	.82	0.00
Divorced/separated/widowed	0.89	−1.04 to 2.82	.37	0.01
Ethnicity				
Chinese	Reference			
Malay	0.30	−0.49 to 1.10	.45	0.00
Indian	−0.40	−1.42 to 0.62	.44	0.00
Highest education level				
Primary and below	Reference			
Secondary	−0.49	−2.27 to 1.29	.59	0.00
Tertiary	−0.72	−2.44 to 1.01	.41	0.00
Employment				
Employed	Reference			
Unemployed	1.19	0.43 to 1.95	.00d	0.06
Economically inactive[b]	1.01	0.19 to 2.00	.02d	0.04
DSM-IV diagnosis				
Schizophrenia spectrum[c] and delusional disorder	Reference			
Mood disorder with psychotic features	1.06	0.01 to 2.11	.05d	0.02
Brief psychotic disorder and psychotic disorder not otherwise specified	0.84	0.05 to 1.63	.04d	0.03
Duration of untreated psychosis	0.00	−0.01 to 0.02	.75	0.02
PANSS				
Positive scale	−0.06	−0.12 to 0.01	.08	0.02
Negative scale	0.01	−0.03 to 0.06	.56	0.00
General psychopathology scale	−0.01	−0.06 to 0.02	.40	0.00
GAF				
Symptomatology	-0.02	−0.07 to 0.03	.41	0.00
Disability	0.02	−0.04 to 0.07	.50	0.00

Abbreviations: GAF, Global Assessment of Functioning; PANSS, Positive and Negative Syndrome Scale.

[a]Beta coefficient was obtained using multiple linear regression.

[b]Economically inactive was defined as students and homemakers.

[c]Schizophrenia spectrum disorders include schizophrenia, schizophreniform disorder and schizoaffective disorder.

[d]Significant at $P \leq .05$.

TABLE 3 AQ-10 scores at study enrolment and their association with clinical outcomes at 1-year (n = 160)

Clinical outcomes	OR[a]	95% CI	*P* value	
Symptomatic remission	0.86	0.70-1.05	.14	
Functional remission	0.86	0.72-1.03	.10	
	β[b]	95% CI	*P* value	Partial eta square
Improvements in PANSS[c]				
Positive scale	−0.18	−0.44 to 0.09	.19	0.01
Negative scale	−0.38	−0.82 to 0.07	.10	0.02
General psychopathology scale	−0.61	−1.13 to −0.09	.02*	0.03
Improvements in GAF[c]				
Symptomatology	−0.80	−1.55 to −0.06	.03*	0.03
Disability	−0.71	−1.44 to 0.19	.06	0.02

Abbreviations: GAF, Global Assessment of Functioning; PANSS, Positive and Negative Syndrome Scale.
[a]Odds ratio obtained using multiple logistic regression where AQ-10 score was treated as the main predictor; adjusted for age, gender, duration of untreated psychosis, baseline employment, DSM-IV diagnosis and corresponding variable at baseline.
[b]Beta coefficient was obtained using multiple linear regression where AQ-10 score was treated as main predictor; adjusted for age, gender, duration of untreated psychosis, baseline employment, DSM-IV diagnosis and corresponding variable at baseline.
[c]Improvements are defined as the change in raw score of the variable of interest between baseline and 1 year.
*Significant at $P \leq .05$.

level (OR = 0.08; 95% confidence interval [CI], 0.01-0.86, *P* = .037) compared to those who completed follow-up; there were no other significant differences.

The number of participants with above cut-off ASDASQ scores was too small for meaningful subgroup analyses. Therefore, findings in Tables 2 and 3 pertain to AQ-10 continuous raw scores.

Upon enrolment into EPIP, gender, DUP, PANSS and GAF scores were not significantly associated with higher AQ-10 scores (Table 2) and all effect sizes were small. Those with higher AQ-10 scores were more likely to be unemployed (β = 1.19; 95% CI, 0.43-1.95, *P* = .002), economically inactive (β = 1.01; 95% CI, 0.19-2.00, *P* = .018) and to have diagnoses of mood disorder with psychotic features (β = 1.06; 95% CI, 0.01-2.11, *P* = .048), brief psychotic disorder or psychotic disorder NOS (β = 0.84; 95% CI, 0.05-1.63, *P* = .038) as compared to schizophrenia spectrum and delusional disorder.

At 1-year follow-up with EPIP and controlling for age, gender, DUP, employment, diagnosis and corresponding variables at baseline, those with higher AQ-10 scores made fewer improvements in the PANSS General Psychopathology Scale (GPS; β = −0.61; 95% CI, −1.13 to −0.09, *P* = .021) and the GAF Symptomatology (β = −0.80; 95% CI, −1.55 to −0.06, *P* = .034). Effect sizes were small. No other statistically significant effects were found in terms of symptomatic or functional remission or in improvement in PANSS positive and negative scales.

4 | DISCUSSION

This study is one of the few to examine the relationship between self- and clinical-rated autistic traits and the course of psychosis recovery in an ethnically diverse group of adults with first-episode psychosis patients. 27.8% (using AQ-10) and 4.4% (using ASDASQ) of participants were determined to have higher levels of autistic traits in this study. Participants with higher autistic traits based on self-report had more employment difficulties and were more likely to have mood disorder with psychotic features, brief psychotic disorder or psychotic disorder NOS at baseline. In comparison, participants with fewer autistic traits were more likely to be diagnosed with schizophrenia spectrum and delusional disorder. Most participants in the study showed improvements in their clinical outcomes at 1-year. However, those with more autistic traits showed fewer improvements in terms of their symptom severity (GAF symptomatology) and general psychopathology scale (PANSS) compared to those with less autistic traits.

The higher rates of positive screening on the self-rated AQ-10 (27.8%) compared to the staff-rated ASDASQ (4.4%) echo findings in the existing literature, with AQ-50 self-reports yielding higher levels of autistic traits in 25% of the first-episode psychosis individuals in Upthegrove et al. (2018) as opposed to 7.8% when the ASDASQ was used in Davidson et al. (2013). The ASDASQ was completed by case managers and family members and may explain the more conservative levels of autistic traits reported compared to self-report.

Unfortunately, there are no validated autism screening questionnaires to measure autistic traits in the early psychosis population nor in our local population at present. The ASDASQ and AQ-10 are widely used in autism research and were thus chosen for use in this study. However, the cut-off scores to determine the presence of higher levels of autistic traits in either of the two questionnaires remain uncertain.

Interestingly, exploratory work by Chisholm et al. (2019) suggested that the optimal cut-off scores on the AQ-50 to detect

poorer clinical outcomes in those with first-episode psychosis were lower than cut-off scores used for the general population. The authors have clarified that this does not mean that a lower AQ score is indicative of ASD in first-episode populations. Rather, the interpretation is that subthreshold but elevated autistic traits are highly clinically relevant in terms of their implications on clinical recovery in those with first-episode psychosis (Chisholm et al., 2019).

The measurement of autistic traits in a population with psychosis is further complicated by the need for the screening tool to have adequate discriminatory power to differentiate between autistic traits and the overlapping impairments relating to social skills and reduced social interest in those with schizophrenia (Lugnegård, Hallerbäck, & Gillberg, 2014). Overall, the measurement of autistic traits in individuals with early psychosis is a complex endeavour and more work is needed in developing a reliable autism screening tool across different informants in this population.

At baseline, those with higher autistic traits were not found to present with more severe psychotic symptoms nor did they experience longer delays to being seen at our service. However, they were more likely to have problems with employment. This association was unsurprising, as Skylark and Baron-Cohen (2017) showed in a study of adults in a general U.S. population that higher levels of autistic traits were associated with lower income. The negative association between autistic traits and income was mainly driven by the subscale of atypical social behaviour and suggested that the individual's career progression may be limited by subclinical levels of ASD-related social atypicality.

In our study, those with higher autistic traits were more likely to be diagnosed with mood disorders with psychotic features, brief psychotic disorders or psychotic disorders NOS at baseline. This could partially be explained by the positive association between autistic traits and depression, anxiety and bipolar disorder symptomatology in both clinical and non-clinical samples (Kanne et al., 2009; Matsuo et al., 2015) and the higher levels of stress vulnerability and emotional dysregulation in those with higher autistic traits that may predispose them to psychotic decompensation and other affective difficulties (Upthegrove et al., 2018).

Although we initially hypothesized that those with higher autistic traits may have poorer psychosis recovery, our study showed that participants with higher autistic traits did not have higher positive or negative psychotic symptoms or lower functioning or poorer outcomes of symptomatic and functional remission at 1-year. The affected components of clinical recovery were the fewer improvements in symptom severity (GAF symptomatology) and general psychopathology scale (PANSS), which may be explained by the persistence of non-psychosis specific difficulties related to autistic traits as opposed to psychosis (eg, affective difficulties, idiosyncratic thought patterns or intense preoccupations; Cochran, Dvir, & Frazier, 2013).

Diagnoses of mood disorders with psychotic features, brief psychotic disorders or psychotic disorders NOS tend to confer a better prognosis in comparison to a diagnosis of schizophrenia and those with higher autistic traits tended to have the former group of diagnoses. In order to remove the confounding effects of diagnosis, a subgroup analysis was performed by looking at the 1-year clinical outcomes in participants with schizophrenia spectrum and delusional disorders only (n = 120). The analysis showed that the reduction in improvements in those with higher autistic traits became more prominent in PANSS GPS (β = −0.81; 95% CI, −1.46 to −0.15, P = .016) and GAF symptomatology (β = −1.29; 95% CI, −2.15 to −0.44, P = .003), with effect sizes of η^2 = 0.06 and η^2 = 0.08 respectively. Those with higher autistic traits also showed fewer improvements in their GAF disability scores (β = −1.06; 95% CI, −1.90 to −0.22, P = .014), with moderate effect size (η^2 = 0.06) and suggested an association between more autistic traits and poorer functioning at 1-year.

Our study results are similar to those of Barlati, Deste, Gregorelli, and Vita (2018), whose study of 75 patients with schizophrenia found that those with higher autistic traits (measured using the interviewer-rated *Autism Diagnostic Observation Schedule* and *Autism Diagnostic Interview-Revised*) showed more psychopathology in terms of negative symptoms, general psychopathology and cognitive difficulties (working memory and processing speed) compared to patients without autistic traits, whereas no differences in positive symptoms or psychosocial functioning were detected. However, the earlier mentioned study of autistic traits in 99 individuals with first-episode psychosis by Chisholm et al. (2019) showed an association between higher levels of autistic traits on the self-reported AQ-50 and lower quality of life, lower functioning and higher levels of current psychotic symptoms. The contrasting findings may be attributed to the differences in methodology and sample population in each study. Nonetheless, it also points to the need for further research in this area.

One limitation of this study is the lack of validated ASD screening tools or cut-off scores for our early psychosis population. Thus, a dimensional approach was taken to analyse AQ-10 raw scores with baseline clinical and demographical data and 1-year clinical outcomes, instead of using a categorical approach of comparing those above and below screening cut-off on the AQ-10. Another limitation is the possibility of sampling bias given the use of convenience sampling during recruitment.

In conclusion, our study findings underscore the need for clinicians to be more vigilant of the possible co-occurrence of elevated autistic traits in people with first-episode psychosis, with an appreciation of how their clinical progress may be influenced by subthreshold autistic traits. Validated screening tools for autistic-related traits and symptoms should also be developed and normed in this population to support earlier identification and reporting.

ACKNOWLEDGEMENTS

This study was supported by the Research Seed Funding (Pilot Study) at IMH/WH from the National Medical Research Council Centre Grant. The authors would like to thank the participants and staff of the Early Psychosis Intervention Programme at the Institute of Mental Health, Singapore, for their support of this study.

ENDNOTES

[1] General linear modelling (GLM) was used to run the linear regression analysis. GLM uses effect coding which is automatically generated by the software when categorical variables are keyed in as a factor variable in the analysis as opposed to dummy coding.

[2] 392 patients were screened for potential participation in the study, using a fortnightly review of the outpatient attendance list. 306 service users were approached based on convenience sampling. 58 declined, 64 were deemed ineligible for the study by their primary psychiatrist or case manager. Four participants were withdrawn as they were erroneously recruited before their 21st birthday.

DATA AVAILABILITY STATEMENT

Research data are not shared.

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REFERENCES

Allison, C., Auyeung, B., & Baron-Cohen, S. (2012). Toward brief "red flags" for autism screening: The short autism spectrum quotient and the short quantitative checklist in 1,000 cases and 3,000 controls. *Journal of the American Academy of Child & Adolescent Psychiatry*, *51*(2), 202–212. https://doi.org/10.1016/j.jaac.2011.11.003

Andreasen, N. C., Carpenter, W. T., Kane, J. M., Lasser, R. A., Marder, S. R., & Weinberger, D. R. (2005). Remission in schizophrenia: Proposed criteria and rationale for consensus. *American Journal of Psychiatry*, *162*(3), 441–449. https://doi.org/10.1176/appi.ajp.162.3.441

Barlati, S., Deste, G., Gregorelli, M., & Vita, A. (2018). Autistic traits in a sample of adult patients with schizophrenia: Prevalence and correlates. *Psychological Medicine*, *49*(1), 140–148. https://doi.org/10.1017/s0033291718000600

Bodén, R., Sundström, J., Lindström, E., & Lindström, L. (2009). Association between symptomatic remission and functional outcome in first-episode schizophrenia. *Schizophrenia Research*, *107*(2–3), 232–237. https://doi.org/10.1016/j.schres.2008.10.004

Chisholm, K., Pelton, M., Duncan, N., Kidd, K., Wardenaar, K. J., Upthegrove, R., … Wood, S. J. (2019). A cross-sectional examination of the clinical significance of autistic traits in individuals experiencing a first episode of psychosis. *Psychiatry Research*, *282*, 112623. https://doi.org/10.1016/j.psychres.2019.112623

Cochran, D. M., Dvir, Y., & Frazier, J. A. (2013). "Autism-plus" spectrum disorders: Intersection with psychosis and the schizophrenia spectrum. *Child and Adolescent Psychiatric Clinics of North America*, *22*(4), 609–627. https://doi.org/10.1016/j.chc.2013.04.005

Constantino, J. N., & Todd, R. D. (2003). Autistic traits in the general population: A twin study. *Archives of General Psychiatry*, *60*(5), 524–530. https://doi.org/10.1001/archpsyc.60.5.524

Davidson, C., Greenwood, N., Stansfield, A., & Wright, S. (2013). Prevalence of Asperger syndrome among patients of an early intervention in psychosis team. *Early Intervention in Psychiatry*, *8*(2), 138–146. https://doi.org/10.1111/eip.12039

First, M. B., Spitzer, R. L., Gibbon, M., & Williams, J. B. (1996). *Structured clinical interview for DSM-IV Axis I disorders (SCID-I), clinician version*. Washington, DC: American Psychiatric Press.

Fraser, R., Cotton, S., Gentle, E., Angus, B., Allott, K., & Thompson, A. (2011). Non-expert clinicians' detection of autistic traits among attenders of a youth mental health service. *Early Intervention in Psychiatry*, *6*(1), 83–86. https://doi.org/10.1111/j.1751-7893.2011.00288.x

Kanne, S. M., Christ, S. E., & Reiersen, A. M. (2009). Psychiatric symptoms and psychosocial difficulties in young adults with autistic traits. *Journal of Autism and Developmental Disorders*, *39*(6), 827–833. https://doi.org/10.1007/s10803-008-0688-x

Kay, S. R., Fiszbein, A., & Opler, L. A. (1987). The Positive and Negative Syndrome Scale (PANSS) for schizophrenia. *Schizophrenia Bulletin*, *13*(2), 261–276. https://doi.org/10.1093/schbul/13.2.261

Lugnegård, T., Hallerbäck, M. U., & Gillberg, C. (2014). Asperger syndrome and schizophrenia: Overlap of self-reported autistic traits using the autism-spectrum quotient (AQ). *Nordic Journal of Psychiatry*, *69*(4), 268–274. https://doi.org/10.3109/08039488.2014.972452

Lundström, S., Chang, Z., Kerekes, N., Gumpert, C. H., Råstam, M., Gillberg, C., … Anckarsäter, H. (2011). Autistic-like traits and their association with mental health problems in two nationwide twin cohorts of children and adults. *Psychological Medicine*, *41*(11), 2423–2433. https://doi.org/10.1017/s0033291711000377

Matsuo, J., Kamio, Y., Takahashi, H., Ota, M., Teraishi, T., Hori, H., … Kunugi, H. (2015). Autistic-like traits in adult patients with mood disorders and schizophrenia. *PLoS One*, *10*(4), e0122711. https://doi.org/10.1371/journal.pone.0122711

Nylander, L., & Gillberg, C. (2001). Screening for autism spectrum disorders in adult psychiatric out-patients: A preliminary report. *Acta Psychiatrica Scandinavica*, *103*(6), 428–434. https://doi.org/10.1034/j.1600-0447.2001.00175.x

Piersma, H. L., & Boes, J. L. (1997). The GAF and psychiatric outcome: A descriptive report. *Community Mental Health Journal*, *33*(1), 35–41.

Skylark, W. J., & Baron-Cohen, S. (2017). Initial evidence that non-clinical autistic traits are associated with lower income. *Molecular Autism*, *8*(1), 61. https://doi.org/10.1186/s13229-017-0179-z

Tang, C., Subramaniam, M., Ng, B. T., Abdin, E., Poon, L. Y., & Verma, S. K. (2016). Clozapine use in first-episode psychosis. *The Journal of Clinical Psychiatry*, *77*(11), e1447–e1453. https://doi.org/10.4088/jcp.15m10063

Upthegrove, R., Abu-Akel, A., Chisholm, K., Lin, A., Zahid, S., Pelton, M., … Wood, S. J. (2018). Autism and psychosis: Clinical implications for depression and suicide. *Schizophrenia Research*, *195*, 80–85. https://doi.org/10.1016/j.schres.2017.08.028

Verma, S., Subramaniam, M., Abdin, E., Poon, L. Y., & Chong, S. A. (2012). Symptomatic and functional remission in patients with first-episode psychosis. *Acta Psychiatrica Scandinavica*, *126*(4), 282–289. https://doi.org/10.1111/j.1600-0447.2012.01883.x

How to cite this article: Zheng S, Chua YC, Tang C, et al. Autistic traits in first-episode psychosis: Rates and association with 1-year recovery outcomes. *Early Intervention in Psychiatry*. 2021;15:849–855. https://doi.org/10.1111/eip.13021