



ORIGINAL ARTICLE

# IQ profiling, autistic traits and social competence in Chinese adults with high-functioning ASD: A comparison between self- and parent-report



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## Abstract

**Background and objectives:** Little research has informed the intellectual profiling of adult ASD population. Besides, current findings on how intelligence level may vary with ASD symptom severity and social competence are mixed due to inconsistent use of parent- and self-report symptom measures.

**Methods:** The present study examined the Wechsler intelligence profile of 23 Chinese ASD adults (mean age = 20.09), who are high-functioning (IQ > 70) and without co-morbidity.

**Results:** Comparing with the normative sample, adults with ASD showed a Wechsler IQ profile with overall lower intellectual functioning. Scattering between indexes was prevalent. Intelligence level did not correlate with ASD symptomatology in both self-report or parent-report.

**Conclusions:** Results did not support a prototypic Wechsler profile among adults with ASD. Intelligence level appears to be an independent construct to features of ASD.

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## Introduction

The diagnostic criteria for autism spectrum disorder (ASD) are conceptualized at the level of behavioral

characteristics. Nevertheless, researchers have devoted considerable effort on investigations of cognitive deficits of the population to explore whether ASD individuals display distinct cognitive features compared to their neurotypical counterparts, providing a more objective account of autistic phenomena.<sup>1</sup> Intellectual functioning is one of the most widely studied cognitive processes in the ASD population. The importance of defining the intellectual functioning is

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also emphasized in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) as it allows clinicians to individualize the diagnosis and communicate a richer clinical description of the affected individual.<sup>2</sup>

## **IQ profiles of ASD population**

The Wechsler intelligence scales are the most researched and applied intelligence assessment tool in the ASD population. Wechsler profiles of children with ASD have been identified. The technical report of Wechsler Intelligence Scale for Children, Fourth Edition (WISC-IV) reported significantly lower indexes scores in children with ASD, including Verbal Comprehension Index (VCI), Perceptual Reasoning Index (PRI), Working Memory Index (WMI), Processing Speed Index score (PSI) and Full Scale IQ (FSIQ), as compared to the normative sample.<sup>3</sup> A commonly reported pattern also included lower scores on WMI and PSI, when compared with VCI and PRI.<sup>4,5</sup> Specifically, weakness in PSI was highlighted in samples of high-functioning autism<sup>6</sup> and Asperger's Syndrome.<sup>7</sup> Other studies that considered the discrepancy between Verbal IQ (VIQ) and Performance IQ (PIQ) suggested a specific profile characterized by significantly higher PIQ than VIQ,<sup>4,8,9</sup> while opposing findings were also reported.<sup>10,11</sup>

At a subtest level, the performance of individuals with ASD was characterized by relatively high scores on the Block Design subtest and relatively low scores on Comprehension subtest.<sup>11-13</sup> Their performance was occasionally accompanied by high scores on Matrix Reasoning and Similarities<sup>1,6</sup> and low scores on the Coding subtest.<sup>14,15</sup>

Intelligence is widely conceived as a stable trait. However, indications of variability are reported in the ASD population. Some longitudinal studies reported stable intellectual functioning in children with ASD over time<sup>16,17</sup> while some observed improvements in overall intelligence quotient.<sup>18,19</sup> It was found that children who possess better cognitive abilities tend to present a more stable intellectual trajectory.<sup>19,20</sup>

Given the change in intellectual profile with age, research efforts are warranted to ascertain if the observed IQ profiles in children maintain in the adult population. A study in Japan attempted to compare the intellectual profiles on WAIS-III among adults with Asperger's Disorder (AS), High-Functioning Autism (HFA), and Pervasive Developmental Disorder Not Otherwise Specified (PDDNOS). Findings suggested the three groups showed a similar pattern of higher VIQ and lower PIQ, while AS showed significantly higher FSIQ and VIQ than the other groups.<sup>21</sup> However, contradictory findings were reported in another study of a group of adults with HFA and AS, that, no VIQ and PIQ differences were reported in WAIS-III profile.<sup>22</sup> Relatedly, it was suggested that cognitive features could not be regarded as a differentiating feature among adults with ASD, ADHD or comorbid ASD/ADHD.<sup>23</sup> More recently, an emerging study on how intellectual functioning related with adaptive functioning among high-functioning adults with ASD suggested an apparent and significant discrepancy between participants' cognitive abilities and adaptive functioning, and the discrepancy was correlated with comorbid psychopathology.<sup>24</sup>

Cross-cultural validation of IQ profiles from the Chinese ASD population is rare, apart from a newly published study in 2017 on children sample.<sup>25</sup> In Hong Kong, the Wechsler Adult Intelligence Scale-Fourth Edition, Hong Kong [WAIS-IV (HK)] was published in 2015 as the first locally-validated adult intelligence tool. With the removal of Comprehension subtest from core subtests, and the introduction of General Ability Index (GAI) and Cognitive Proficiency Index (CPI), whether the indicators of profile characteristics in existing literature still apply requires exploration.

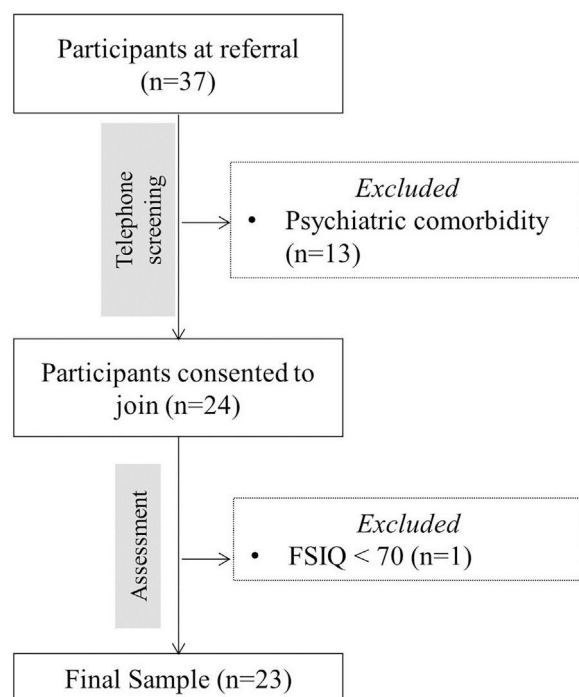
## **IQ and ASD symptomatology**

Relatedly, some research focused on how intelligence level may influence symptom presentation in ASD. In the low-functioning spectrum, a moderating effect of intellectual functioning on the expression of ASD symptoms was suggested.<sup>26</sup> However, whether the observed pattern can be generalized in the high-functioning spectrum still warrants investigations. Intuitively, individuals with higher intelligence level, who possess better cognitive ability, may adjust to social demand more readily, suggesting a higher level of social competence. Supporting this hypothesis, intelligence level showed a positive correlation with parent-rated adaptive communication skills in a group of adolescents and adults with ASD.<sup>27</sup> However, it was also showed that higher IQ predicted lower levels of self-perceived social competence in a group of children with high-functioning ASD.<sup>28</sup> Inconsistent findings were presented between parent- and self-ratings.

Clinical practices for children with ASD commonly rely on parent-report and behavioral ratings. Moving along the developmental continuum, self-report measures are increasingly emphasized to understand one's subjective experience, especially for adults who are developmentally mature and cognitively able. Notably, the discrepancy between parent- and self-report of autistic traits was documented in ASD research.<sup>29</sup> In the development of the adult version of Autism Spectrum Quotient (AQ), it was suggested that adults with ASD could provide a reliable report on their autistic traits.<sup>30</sup> However, the experience of validating AQ in Hong Kong was different. Parent-report was found to have better psychometric properties and was a more reliable measure than self-report.<sup>31,32</sup> The discrepancy between parent- and self-report suggests a different pattern between the two raters' report, which needs to be clarified empirically.

## **Aim of study**

Prior research on adults with ASD had yet to clarify the characteristics of the intellectual profile, including but not limited to the typical VIQ-PIQ difference.<sup>21,22</sup> The present study aimed to update the intelligence profile of adults with ASD following the theoretical framework of intelligence suggested in the latest Wechsler intelligence scale, WAIS-IV, among a group of Chinese adults with ASD. It is hypothesized that in comparison with their neurotypical counterparts, adults with ASD will reveal an overall significant lower intellectual functioning as indicated by the FSIQ and index scores. The second purpose of the present



**Figure 1** Flow of participants.

study is to investigate the relationship between intellectual functioning and perception of symptomatology among ASD adults, with a focus on social competence and overall autistic traits. Whether intelligence level relates differently to self- and parent-ratings of social competence and autistic traits will be explored.

## Methods

### Participants

Inclusion criteria for the study included (1) aged 17 or above; (2) a previous diagnosis of Autistic Disorder, Asperger's Syndrome or Atypical Autism in accordance with DSM-IV-TR criteria (APA, 2000), or a diagnosis of Autism Spectrum Disorder in accordance with DSM-5 (APA, 2013) by registered psychiatrists or clinical psychologists; (3) an intelligence level of 70 or above; and (4) native speakers of Cantonese, a local dialect of Southern China. To facilitate the study of intelligence profile of adulthood ASD per se, exclusion criteria of the present study included the presence of psychiatric comorbidity, to preclude the unmeasurable effect of psychiatric conditions and use of psychiatric medication on cognitive functions.<sup>33,34</sup>

Participants were enrolled members of a community-based center for adolescents and adults with ASD and their families. The recruitment procedure of the current study lasted for more than twelve months to gather the current sample size. As shown in Fig. 1, thirty-seven participants meeting the criteria in age and ASD diagnosis were screened. Thirteen of them were excluded due to psychiatric comorbidity. One of them did not fulfill the criterion on intelligence level after being assessed. The final sample comprised twenty-three adults, with a male

majority ( $n = 20$ ) with an age range from 17 to 30 years old ( $M = 20.09$ ,  $SD = 3.32$ ). The number of participants diagnosed with Autistic Disorder, Asperger's Syndrome, Atypical Autism and Autism Spectrum Disorder was 4, 6, 6 and 7 respectively.

### Measures

#### The Wechsler Adult Intelligence Scale-Fourth Edition (Hong Kong) [WAIS-IV (HK)]

The WAIS-IV (HK)<sup>35</sup> is a standardized measure of intellectual ability and cognitive processing for individuals aged 16 to 90 in Hong Kong. It consists of ten core subtests, namely Block Design, Similarities, Digit Span, Matrix Reasoning, Vocabulary, Arithmetic, Symbol Search, Visual Puzzles, Information and Coding. The subtests are represented by scaled scores (mean = 10, standard deviation = 3). The subtests are clustered into Full-Scale Intelligence Quotient (FSIQ) and four composite indexes, which are represented as standard scores (mean = 100, standard deviation = 15). Each index score is comprised of several subtests: the Verbal Comprehension Index (VCI) includes the Similarities, Vocabulary and Information subtests; the Perceptual Reasoning Index (PRI) includes the Block Design, Matrix Reasoning and Visual Puzzles subtests; the Working Memory Index (WMI) includes the Digit Span and Arithmetic subtests; and the Processing Speed Index (PSI) includes the Symbol Search and Coding subtests. The General Ability Index (GAI) and Cognitive Proficiency Index (CPI) are two summary index scores where the GAI is derived from the VCI and the PRI subtests, reflecting reasoning abilities; and the CPI is comprised of the WMI and the PSI subtests, reflecting cognitive efficiency and proficiency.

Local standardization models the development of WAIS-IV, which involved translation of test materials, pilot analysis, finalization of test materials, data collection on standardization and establishment of normative figures. The sampling of WAIS-IV (HK) included 387 individuals who were recruited by stratified sampling. The number of individuals in each category of age, sex, education level and district of residence was weighted in reference to data on Hong Kong Census 2011. The subtests and indexes of WAIS-IV (HK) demonstrated satisfactory internal consistency (Fisher's  $z = .73-.98$  for subtests; Fisher's  $z = .86-.99$  for indexes) and test-retest reliability ( $r = .70-.96$  for subtests;  $r = .85-.94$  for indexes). The scale also demonstrated satisfactory convergent validity ( $r = .65-.77$ ) and construct validity on its 4-factor model ( $X^2 = 71.4$ ; RMSEA = .066).

#### Multidimensional Social Competence Scale (MSCS)

The MSCS is a 77-item questionnaire assessing social competence from a multidimensional perspective in high-functioning individuals with ASD, completed by primary caregivers.<sup>36</sup> The questionnaire has seven domains with 11 items for each, and it adopts a Likert rating scale from 1 to 5, yielding a total score ranging from 77 to 385, with a higher score indicating better social competence. In addition to the total score, the questionnaire also generates 7 domain measures, which are Social Motivation (SM), Social Inferencing (SI), Demonstrating Empathic Concern (DEC), Social Knowledge (SK), Verbal Conversation Skills (VCS), Nonverbal Sending Skills (NSS) and Emotional Regulation

**Table 1** Differences in WAIS-IV (HK) index and subtest scores between ASD and normative samples.

Variables	Mean $\pm$ SD	<i>t</i> (22)	<i>p</i>	Cohen's <i>d</i>
FSIQ	87.87 $\pm$ 12.00	-4.846	<.001	-1.01
VCI	89.87 $\pm$ 17.64	-2.755	.012	-0.57
Similarities	8.57 $\pm$ 3.07	-2.240	.036	-0.47
Vocabulary	7.57 $\pm$ 3.96	-2.946	.007	-0.61
Information	8.26 $\pm$ 3.58	-2.328	.030	-0.49
PRI	88.61 $\pm$ 11.57	-4.721	<.001	-0.98
Block design	8.01 $\pm$ 2.33	-3.931	.001	-0.82
Matrix reasoning	8.35 $\pm$ 2.87	-2.761	.011	-0.58
Visual puzzles	7.65 $\pm$ 2.77	-4.060	.001	-0.85
WMI	93.26 $\pm$ 16.56	-1.951	.064	-0.41
Digit span	8.91 $\pm$ 3.25	-1.606	.123	-0.33
Arithmetic	8.52 $\pm$ 3.69	-1.921	.068	-0.40
PSI	84.78 $\pm$ 8.49	-8.596	<.001	-1.79
Symbol search	6.61 $\pm$ 1.99	-8.156	<.001	-1.70
Coding	7.74 $\pm$ 1.66	-6.542	<.001	-1.36
GAI	88.39 $\pm$ 13.49	-4.127	<.001	-0.86
CPI	88.30 $\pm$ 10.55	-5.316	<.001	-1.11

FSIQ: Full-scale Intelligence Quotient; VCI: Verbal Comprehension Index; PRI: Perceptual Reasoning Index; WMI: Working Memory Index; PSI: Processing Speed Index; GAI: General Ability Index; CPI: Cognitive Proficiency Index.

(ER). The Chinese version of the MSCS was validated by Leung (2014).<sup>37</sup> It yielded a 7-dimensional factor solution that correlates with the original version ( $r > .9$ ). It also demonstrated excellent internal consistency (Cronbach's  $\alpha = .85-.97$ ), discriminant validity ( $AUC = .78-.90$ ), and test-retest reliability ( $r = .77-.90$ ). In the current study, average scores of the items (ranging from 1 to 5) in each domain were used as the outcome variables.

#### Autism Spectrum Quotient-10 items (AQ-10)

The Autism Spectrum Quotient (AQ) is a questionnaire designed for assessing autistic traits.<sup>30</sup> It comprises 50 questions in total, assessing domains of social skill, attention switching, attention to detail, communication and imagination. The AQ demonstrates good internal consistency (Cronbach's  $\alpha = .65-.77$ ) and test-retest reliability ( $r = .7$ ). By drawing two questions, each from the five domains of AQ, the condensed version, AQ-10 was recommended as a valid and reliable screening tool.<sup>38</sup> The self-report and parent-report of AQ in Chinese were validated by Poon (2011)<sup>31</sup> and Shu (2011)<sup>32</sup> respectively. The Chinese AQ-10 also demonstrated comparable predictive validity ( $AUC = .99$ ) to Chinese full-form AQ and marginally satisfactory internal consistency (Cronbach's  $\alpha = .67$ ).<sup>39</sup> The current study adopts a binary scoring of 1 (presence of symptom) and 0 (absence of symptom), yielding a maximum score of 10.

#### Procedures

The study had been reviewed and received ethical approval concerning the Declaration of Helsinki (2013) from the hosting organization, New Life Psychiatric Rehabilitation Association. Informed consent to the study was obtained from the participants and their parents.

Study participants were referred by local psychiatric centers and educational institutes to enroll at the Jockey Club iREACH Social Competence Development and Employment Support Center, New Life Psychiatric Rehabilitation Association for services targeted for adolescents and adults with ASD and their families. The enrolled participants all had a confirmed diagnosis of Autistic Disorder, Asperger's Syndrome, Atypical Autism or ASD. A written certification on one of the above diagnoses made by a registered psychiatrist or clinical psychologist had to be presented at enrollment. Standard diagnostic procedures employed by local professionals included a diagnostic interview with the caregiver, use of standardized questionnaires, and behavioral observation of the client, to check the manifestation of symptoms on the fulfillment of DSM-IV-TR or DSM-5 criteria.

Upon referral, participants were screened for eligibility for the study. Participants whom with comorbidity stated in certification letter or reported to be on psychiatric medication at telephone screening were excluded. Written consent was obtained upon agreement to join the study. They were arranged with individual intellectual assessment and were asked to complete a set of questionnaires on the participants' social competence, autistic traits and general psychopathology. Participants were debriefed on their intellectual performance as compensation for participation.

## Results

#### IQ profiling

##### Between-group comparisons with normative sample

The index scores and standard scores for each subtest in WAIS-IV (HK) are summarized in Table 1. Results of one-sample *t*-test revealed that adults with ASD obtained significantly lower scores in all indexes and subtests, as



**Table 2** Differences in index score discrepancies between ASD and normative sample.

Compared indexes	Number of positive discrepancy	Number of negative discrepancy	% of discrepancies in current sample	% of discrepancies in normative sample	$\chi^2$ (1)	$p$	Cramer's $\phi$
VCI-PRI	13	10	56.5	21.3	17.015	<.001	0.61
VCI-WMI	12	11	47.8	19.1	20.785	<.001	0.67
VCI-PSI	12	11	47.8	21.7	16.163	<.001	0.59
PRI-WMI	13	10	43.5	19.1	21.040	<.001	0.68
PRI-PSI	13	10	43.5	15.7	28.719	<.001	0.79
WMI-PSI	14	9	39.1	19.1	5.804	.016	0.36

VCI: Verbal Comprehension Index; PRI: Perceptual Reasoning Index; WMI: Working Memory Index; PSI: Processing Speed Index.

compared to the normative sample mean of 100 and 10 respectively.

The number of discrepant observations between any two index scores, which meet the requirement of statistical significance at the .05 probability level, was calculated.

Percentage of discrepant observations between index scores in the current sample was compared with that in the normative sample using Chi-square test of independence. As summarized in Table 2, significant differences were found in all pairs of compared indexes: VCI and PRI [ $\chi^2(1)=17.015$ ,  $p<.001$ ], VCI and WMI [ $\chi^2(1)=20.785$ ,  $p<.001$ ], VCI and PSI [ $\chi^2(1)=16.163$ ,  $p<.001$ ], PRI and WMI [ $\chi^2(1)=21.040$ ,  $p<.001$ ], PRI and PSI [ $\chi^2(1)=28.719$ ,  $p<.001$ ], as well as WMI and PSI [ $\chi^2(1)=5.804$ ,  $p=.016$ ]. These results indicated that discrepant profiles were more commonly observed in the current sample than the normative sample.

#### Within-group comparisons

Repeated measures ANOVAs were conducted to examine within-group differences among index scores and subtest scores. The differences among VCI, PRI, WMI and PSI scores [ $F(3,20)=2.387$ ,  $p=.099$ ], and that between GAI and CPI [ $F(1,22)=.003$ ,  $p=.958$ ] were not significant. Within-group differences in subtests were also found to be not significant [ $F(9,14)=1.448$ ,  $p=.258$ ].

#### Relationship between IQ, autistic traits and social competence

Differences in AQ score and MSCS total score between self- and parent-report were tested using independent samples  $t$ -test. Self-ratings in AQ ( $M=6.21$ ,  $SD=2.12$ ) tended to score lower than parent-ratings ( $M=6.71$ ,  $SD=1.33$ ), yet the difference did not reach statistical significance [ $t(27)=.748$ ,  $p=.463$ ]. For MSCS total score, self-ratings ( $M=3.14$ ,  $SD=.38$ ) was significantly higher than parent-ratings ( $M=2.65$ ,  $SD=.26$ ) [ $t(26)=-3.879$ ,  $p=.002$ ].

Correlational analysis between IQ and ASD symptomatology measures are summarized in Table 3. For autistic traits, neither self-ratings nor parent ratings on AQ showed any significant correlation with IQ index scores. For social competence, parent-rating in Social Knowledge subscale was correlated with FSIQ [ $r(35)=.688$ ,  $p=.009$ ], no other MSCS variables correlated with IQ index scores in both self-ratings and parent ratings.

## Discussion

The present study examined the WAIS-IV (HK) profile of Chinese adults with ASD, and the possible effects of intellectual functioning on the perception of symptomatology among adults with ASD, with focus on social competence and overall autistic traits.

#### IQ profiling

The current study identified a few characteristics of the WAIS-IV profiles in adults with ASD which support the current findings. Adults with ASD showed lower general intellectual functioning and weaker performance across a range of cognitive domains, as compared to the normative population. Weakness in processing speed, which is consistent with the findings in children population,<sup>6</sup> was reflected by the largest effect size denoted in PSI and its constituent subtests when compared with the normative sample. This preliminarily suggested that a deficit in processing speed tended to persist in the ASD population despite maturity with age.

In general, we noticed that adults with ASD performed better on subtests that are structured, brief and motor-free, i.e. Digit Span and Arithmetic. They were comparatively disadvantaged in subtests that are timed and involve motor performance. Previous studies noted that children and adults with ASD showed comparable performance to neurotypical individuals in processing speed tasks that are free of motor demand.<sup>40,41</sup> Future studies that directly compare processing speed performance in motor and non-motor tasks may give better insights into where the limitation in processing speed indeed lies.

Scattered profiles were typical in the current sample. In respect to the classic VIQ-PIQ split, the current study reported a percentage as high as 56.5% of having a significant discrepancy between VCI and PRI. However, the discrepancies did not necessarily follow the prototypic pattern of higher PIQ and lower VIQ. Instead, comparable frequencies in both directions were observed. The pattern does not support the conventional assumption that individuals with ASD tend to present with weaker verbal reasoning abilities, but more a discordance between verbal and perceptual reasoning abilities.

Given such a high prevalence of discrepant profiles in the current sample, one would expect a profile with peaks

**Table 3** Correlation between IQ index scores and ASD symptomatology measures.

	FSIQ	VCI	PRI	WMI	PSI	GAI	CPI
<i>Self-ratings</i>							
AQ-10	.030	-.242	-.059	.148	.314	-.156	.371
MSCS							
SM	-.268	-.005	-.277	-.143	.021	-.224	-.225
SI	.224	.226	.332	.083	-.146	.269	-.083
DEC	-.088	.054	-.052	-.066	-.137	-.049	-.203
SK	.178	.509	-.024	-.225	.209	.324	-.259
VCS	.355	.554*	-.006	.377	-.383	.367	.153
NSS	.476	.854**	.070	.048	-.109	.644*	-.036
ER	.093	.236	.032	.161	-.105	.125	.040
Total score	.151	.422	.005	.041	-.130	.238	-.130
<i>Parent-ratings</i>							
AQ-10	-.296	-.452	-.145	-.272	.124	-.291	-.133
MSCS							
SM	-.008	-.132	-.172	.142	.350	-.280	.252
SI	.525	.109	.486	.430	.160	.345	.511
DEC	-.201	-.372	-.059	-.044	.083	-.288	.080
SK	.688**	.456	.483	.422	.458	.560*	.572*
VCS	.092	.052	-.153	.264	.191	-.054	.219
NSS	-.223	-.021	-.211	-.372	.303	-.141	-.316
ER	-.017	-.211	-.146	.269	.209	-.247	.341
Total score	.287	-.026	.086	.389	.464	-.014	.528

FSIQ: Full-scale Intelligence Quotient; VCI: Verbal Comprehension Index; PRI: Perceptual Reasoning Index; WMI: Working Memory Index; PSI: Processing Speed Index; GAI: General Ability Index; CPI: Cognitive Proficiency Index; AQ-10: Autism Spectrum Quotient-10 items; MSCS: Multidimensional Social Competence Scale; SM: Social Motivation subscale; SI: Social Inferencing subscale; DEC: Demonstrating Empathic Concern subscale; SK: Social Knowledge subscale; VCS: Verbal Conversation Skills subscale; NSS: Nonverbal Sending Skills subscale; ER: Emotional Regulation subscale.

\*  $p < .05$ .

\*\*  $p < .01$ .

and troughs to emerge. Contrary to the expectation, within-group comparisons did not reveal any relative strength or weakness in the current sample. One possible hypothesis is that individual differences exist that peaks and troughs across profiles do not fall consistently on particular indexes. Differences found in individual profiles might thus cancel out each other in with-in group analysis.

The high prevalence of scattered profiles supported the heterogeneous nature of ASD population and has prevented a recommendation of a reference profile in making ASD diagnosis. Intelligence assessment for adults with ASD may better serve the purpose of understanding cognitive strengths and weaknesses, to guide treatment planning and development of one's potential.

### Intellectual functioning and perception of symptomatology

Another purpose of the current study was to examine the relationship between intelligence level and the report of ASD symptomatology. Previous reports on IQ and symptom perception were mixed. Some studies on children identified a positive correlation between IQ and parent-report communication skills<sup>27</sup> and a negative correlation between IQ and self-perceived social competence,<sup>28</sup> while some suggested a dissociation between IQ and social ability in autism.<sup>42</sup>

In adults, the discrepancy between intellectual ability and adaptive functioning was documented using parent-reports of adaptive functioning using the ABAS-II.<sup>24</sup> Our study supported and extended the previous studies by including both self- and parent-ratings on social competence and autistic symptoms. Lack of association between intellectual functioning and ASD symptomatology was reported not only in parent-report but also self-report, providing additional evidence in the dissociation between the two. While adults with higher intelligence level appeared to possess more social knowledge as evaluable by their parents, this was not translated into overall social competence, which comprises of other essential domains, embedded in behavioral and emotional terms. Intelligence level appears to be an independent construct to features of ASD, including autistic traits and social competence. The findings also supported the practice of specifying intellectual level suggested by DSM-5 in making diagnosis and intervention planning to communicate a richer clinical description of the affected individual.

On self- and parent-ratings on symptom measures, the discrepancy between informant reports of autistic traits was reported across age groups. Previous studies on children and adolescents with ASD suggested that fewer autistic traits and more empathic features were revealed in self-reports and parent reports.<sup>29</sup> Entering into adulthood, employing self-report in ASD population were brought by the switch of

informants from parents and teachers to adults themselves in the golden screening tool, AQ. Nevertheless, there are not any established studies directly comparing self-ratings and parent-ratings on autistic symptoms and social competence in adulthood. The current study provided preliminary data suggesting that adults with ASD tended to rate themselves in a more positive light than their parents did, as indicated by significantly higher mean MSCS total score and suggestively lower mean AQ score in self-ratings. This observation was consistent with that reported in children with ASD<sup>29</sup> and our observation in a group of adolescents participated in social competence training,<sup>43</sup> which potentially contributed by both the weakness in self-perception among the youths and accumulated knowledge on ASD symptoms by parents.<sup>29</sup>

The findings called for a multi-informant practice in clinical assessment with individuals affected by ASD. The use of self-report symptom measures among high-functioning adolescents and adults with ASD does not only facilitate clinician's understanding on individuals' self-perception and contribute to an integrative assessment on their functioning and deficit; it also cultivates a sense of respect to client's perspective on their condition and their autonomy in intervention planning.

## Limitations

The generalizability of findings and power of statistical analysis are potentially limited by relatively small sample size. Further studies can also consider including control groups of neurotypical individuals and other neurodevelopmental disorders to enhance the validity of findings. The diagnoses of the current sample were made by other professionals in the community or psychiatric settings. It was difficult to ensure the use of gold-standard instruments in assessing each participant and monitor the inter-rater bias in making the diagnoses. To yield a more comprehensive profile on the neurocognitive function among adults with ASD, future studies may also include a set of neurocognitive tasks that assess abilities such as learning and memory, problem-solving and set-shifting, which are not covered by tasks in Wechsler Scales.

Concerning the effect of intelligence on perception on symptomatology, the current study only included measures of overall autistic traits and level of social competence. Both the present study and that by Johnson et al. (2009)<sup>29</sup> showed that differentiation between parent- and self-ratings was not consistent across measures. A more systematic exploration thus could be achieved by including measures of other typical traits of ASD, such as on Theory of Mind, empathy and repetitive and restrictive behaviors. Future studies may also include clinician-rating in behavioral measures as calibration with parent- and self-ratings.

## Conclusion

The current results suggested an adult Wechsler intelligence profile with an overall lower intellectual functioning, showing relative weakness in Processing Speed domain. Scattered cognitive profiles with individual differences were prevalent in the current sample. Results did not support a prototypic Wechsler profile among adults with ASD. Besides, among

adults with ASD, intelligence level did not correlate with severity of ASD symptoms or level of social competence in both self-report and parent report. Intelligence level appears to be an independent construct to features of ASD. In general, adults tended to perceive themselves as less problematic than their parents did, the differential pattern existed between parent- and self-perception of ASD symptomatology, which suggests caution in clinical practices and further theoretical investigation.

## Conflict of interest

The authors have no conflict of interest to declare.

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