Validating Three Common Self-Report Measures of Social Functioning: Implications for
Autism Research

Elizabeth A. Kaplan-Kahn¹, Natalie Russo^{1*}, & Grace Iarocci²

¹ Department of Psychology, Syracuse University, Syracuse, NY, USA

² Department of Psychology, Simon Fraser University, BC, Canada

*** Corresponding Author (NR)**

nrsusso@syr.edu

Conflict of Interest:

Elizabeth A. Kaplan-Kahn and Natalie Russo declares that they have no conflict of interest. Grace Iarocci is a developer of the Multidimensional Social Competence Scale.

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Abstract

Social functioning difficulties are a core diagnostic feature of autism spectrum condition (ASC) and are commonly assessed in ASC research. Many measures have been created to assess the various dimensions of social functioning; thus, it is important to evaluate how each scale captures these latent constructs in order to integrate results from studies using different measures. The current brief report assessed the convergent validity (at the subscale level) of three commonly used social functioning scales in ASC research: The Autism Quotient, the Multidimensional Social Competence Scale, and the Social Responsiveness Scale. Amongst a sample of nonclinical adults, the scales showed robust convergent validity between theoretically related subscales, indicating sensitivity to variation in social functioning abilities across diagnostic labels.

Keywords: Social functioning, Convergent validity, Self-report, Assessment

Introduction

Social functioning difficulties have been one of the defining and most recognizable characteristics of autism since its original conception as a psychological diagnosis (American Psychiatric Association, 2013; Kanner, 1943). Although impairment in social functioning has been a consistent definitional characteristic of autism, social functioning has proven a particularly difficult latent construct to measure empirically because it involves the coordination of many different types of skills, is context dependent, and the criterion changes based on developmental periods (Waters and Sroufe, 1983). A multitude of scales have been developed to assess social functioning in autism, such as the Children's Communication Checklist (Bishop, 1998), the Autism Spectrum Quotient (Baron-Cohen et al., 2001), the Social Communication Questionnaire (Rutter et al., 2001), the Social Responsiveness Scale (Constantino, 2003; Constantino and Gruber, 2012), the Contextual Assessment of Social Skills (Ratto et al., 2011), and the Multidimensional Social Competence Scale (Yager and Iarocci, 2013). In order to integrate and make sense of the findings of studies using different scales, it is critical to validate these scales within the same sample to ensure that they are measuring the same construct.

Even though scant research has ensured the comparability of such social functioning measures, the use of multiple scales, even within a single study, is not uncommon in the psychiatric literature. For example, changes in autistic children's Social Responsiveness Scale t-scores have been examined in relation to changes in their parent's scores on the Autism Spectrum Quotient, Empathy Quotient, and Systematizing Quotient (Hasegawa et al., 2015). In another study, while neurotypical

participants were screened using the Autism Spectrum Quotient, autistic participants were assessed using the Social Responsiveness Scale (Ratto et al., 2011). Without a thorough understanding of whether the scales demonstrate meaningful convergent validity, interpreting scores from multiple measures presents empirical challenges for researchers, as well as practical constraints on the scales' utility for clinicians. Further, data from a recent meta-analysis of social functioning correlates demonstrate that many of the cognitive (e.g., theory of mind and executive function) and developmental (e.g., joint attention, pretend play and imitation) explanations of social functioning show effects which were insignificant, small, or both across autistic and neurotypical groups (Bottema-Beutel et al., 2019). The authors put forth the call that "given the generally low correlations for many of the constructs...it is likely that more sophisticated theoretical models of social functioning will need to be developed and tested" (Bottema-Beutel et al., 2019, p. 166); however, a prerequisite to developing and testing such models is a solid evidence base supporting the use of scales specifically designed to measure social functioning.

The main objective of the current report was to assess the convergent and divergent validity of social functioning scales that are commonly used in autism research among a group of non-clinical adults. The scales that were selected each approach the conceptualization of social functioning from slightly different theoretical frameworks, so it is important to assess whether and how they measure different dimensions of social functioning. Self-report scales were selected based on the following criteria. First, the measures needed to capture contextual and developmental changes of social functioning. Though only self-report scales were used in the current

report, each of the measures chosen have additional forms that caregivers and/or teachers can fill out for younger children and adolescents. Measuring social functioning within developmental context is crucial because different behaviors are considered socially competent at different stages of life (Waters and Sroufe, 1983). For example, a toddler might exhibit proficient social functioning by following a parent's gaze to establish joint attention and using phrase speech to communicate; these same behaviors, however, would not be considered sufficient for a school-aged child to have proficient social functioning. Further, items on the scales were examined to ensure that they did not include context-specific wording that would limit the scope of the respondents' answers. Though there is always a trade-off between the degree of specificity of a measure and its ability to tap into the broad theoretical constructs, broadband assessments are important because items should aim to measure the flexible use of social functioning across a variety of contexts (Waters and Sroufe, 1983).

Second, whereas it is critical that the scales are valid measures of social functioning abilities in autistic individuals, for researchers to flexibly use these scales in psychiatric research, it is equally important to ensure that they are sensitive to varying social functioning abilities in sub- and non-clinical populations. There is evidence to suggest that, regardless of the way in which social functioning is measured, there is not a clear bimodal distribution that distinguishes autistic individuals from neurotypical individuals, but rather a continuum of social functioning abilities that transcends diagnostic labels (Constantino et al., 2000; Constantino and Todd, 2003; Spiker et al., 2002; Waterhouse et al., 1996). This suggests that social competence reflects a dynamic and dimensional construct, rather than a categorical presence or absence. The

shift from categorical diagnostic systems, such as the Diagnostic and Statistical Manual of Mental Disorders, to dimensional systems, such as National Institutes of Mental Health Research Domain Criteria (RDoC), has important implications for both clinical and research practices. In the context of social functioning research, measures used in empirical research should be able to capture meaningful variation across the entire continuum of abilities, including those who are considered neurotypical.

Third, due to the well-established consensus that social functioning can vary greatly among autistic individuals (Borden and Ollendick, 1994), scales should be able to capture potentially meaningful differences in profiles of social functioning abilities. There is substantial heterogeneity in both the kind and severity of social deficits that autistic individuals experience (Happé et al., 2006; Wing and Gould, 1979), so although much of autism research has focused on between-group differences, comparing autistic individuals to neurotypical individuals, it is also important to recognize and explore meaningful within-group variability (Von Eye and Bergman, 2003). Measures that fail to discriminate between different social functioning phenotypes run the risk of conflating meaningful profiles, creating sensitivity and specificity concerns in both research and clinical settings. For researchers, a failure to recognize meaningful patterns of variation within a group may lead to erroneous statistical analyses and, therefore, conclusions about their data (Beauchaine, 2003); for clinicians, interventions have been shown to be more efficacious if they are sensitive to meaningful clusters of variability (Von Eye and Bergman, 2003). Clearly, social functioning measures that recognize profiles of strengths and weaknesses across different social competency dimensions have increased utility in autism research.

Based on these criteria, three self-report social functioning scales were selected – the Autism Spectrum Quotient (AQ; Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001), the Multidimensional Social Competence Scale (MSCS; Yager & Iarocci, 2013) and the Social Responsiveness Scale, Second Edition (SRS-2; Constantino & Gruber, 2012). The scales were chosen because they met the necessary requirements for the assessment of social functioning including: 1) capturing contextual and developmental changes of social functioning, 2) sensitivity to variation in social functioning abilities within a non-clinical population, and 3) the creation of meaningful profiles of social functioning abilities within autism. Each of the scales include specific subscales and the correlations between these subscales as well as the total scores were examined.

The current within-group comparison of these scales provides a necessary update and in-depth analysis of the measures which builds on the extant literature. Scores on the MSCS has been previously compared to a selective subset of scores on the AQ (Tafreshi et al., 2018) and the first edition of the Social Responsiveness Scale (Yager and Iarocci, 2013); however, they have not been examined in relation to the current version of the SRS-2. Further, although total scores on the AQ have also been compared to total scores on the original version of the SRS (Armstrong and Iarocci, 2013; Ingersoll et al., 2011; Nishiyama et al., 2014), a complete examination of the relationship of the different subscales has never been completed. Thus, whereas past evidence of convergent validity is available, it is neither as current nor comprehensive as is required for extensive and/or interchangeable use of the scales in psychiatric research.

The validation of measures at the level of subscales is crucial in order to ensure that related scales are tapping into similar constructs and can be reliably used to discriminate social competency profiles in autism research. While subscales assessing similar dimensions of social functioning would provide convergent validity for the scales, examining social functioning scales on the subscale level also affords analysis of specificity and divergent validity. For example, the AQ includes an Attention to Detail subscale that, although related to autism traits, is not a measure of social functioning. As the MSCS and the SRS-2 were created to be more specific measures of social functioning, rather than measures of general autism traits, neither includes a subscale related to attention to detail, and we would thus not expect this subscale of the AQ to be significantly correlated with other subscales on the MSCS or SRS-2. As research specifying subgroups of meaningful profiles becomes more common in autism research (Uljarević et al., 2020), an understanding of how specific subscales on different social functioning measures relate to each other will continue to be an important consideration in interpreting results.

Methods

Participants

50 participants (26 females) at a large northeastern university were recruited through the Psychology Research Participation Pool (SONA) and received credit in entry-level psychology courses for participating in the research study. As the current study was part of a broader research project utilizing electrophysiological methods, any participants with a history of seizure disorders, psychiatric problems, and non-corrected

vision problems were excluded. Participants were between the ages of 18.2 and 22.3 years with a mean age of 19.4 years (SD = 1.1 years).

Measures

The Adult Autism Spectrum Quotient. The Autism Spectrum Quotient (AQ; Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001) consists of 50 items scored on a four-point Likert scale, ranging from *definitely agree*, *slightly agree*, *slightly disagree*, to *definitely disagree*. The completed measure includes five subscales which were theoretically determined by the scale's authors – Social Skills (SS), Attention Switching (ATSW), Attention to Detail (ATDE), Communication (COMM), and Imagination (IMG) – as well as an overall Total score. Items are scored dichotomously and are reported in terms of raw scores that range from 0 to 50, with higher scores indicating a greater degree of symptoms commonly associated with autism. A score of 32 on the AQ is typically considered a useful cut-off for distinguishing between autistic and neurotypical participants, though the screener should not be used in isolation to diagnose autism.

The AQ was developed and tested on four groups of individuals including 58 autistic adults, 174 randomly selected comparison adults, 840 Cambridge University students and 16 UK Mathematics Olympiad winners (Baron-Cohen et al., 2001). Based on this sample, Cronbach's alpha coefficients for each of the five domains were found to be moderate to high (Social Skills, = .77; Attention Switching = .67; Attention to Detail = .63; Communication = .65; Imagination = .65). Based on a subset of the neurotypical Cambridge University sample who retook the AQ a second time after two weeks, test-retest scores did not differ significantly ($t(16) = 0.3$, $p = .75$) and were strongly correlated

($r = 0.7$, $p = .002$), indicating sufficient reliability (Baron-Cohen et al., 2001). Evidence suggests that the AQ is suitable for autism screening purposes, demonstrating good diagnostic validity (sensitivity = 0.95, specificity = 0.52, positive predictive value = 0.84, and negative predictive value = 0.78; Woodbury-Smith et al., 2005)

The Multidimensional Social Competence Scale. The Multidimensional Social Competence Scale (MSCS; Yager & Iarocci, 2013) consists of 77 items scored on a 5-point Likert-scale, ranging from *not true or almost never true*, *rarely true*, *sometimes true*, *often true*, to *very true or almost always true*. The measure generates seven subscales – Social Motivation (SM), Demonstrating Empathic Concern (DEM), Nonverbal Sending Skills (NSS), Verbal Conversation Skills (VCS), Emotional Regulation (ER), Social Knowledge (SK), and Social Inferencing (SI) – as well as an overall Total score. Subscales on the original MSCS were theoretically developed by the authors and empirically validated using confirmatory factor analysis (CFA). The CFA returned satisfactory fit indices for the hypothesized seven-factor model (standardized root mean square residual (SRMR) = 0.086; root mean square error of approximation (RMSEA) = 0.057 (90% confidence interval (CI) = 0.054-0.060); and comparative fit index (CFI) = 0.93). Total scores on the MSCS scales range from 77 to 385, with lower scores designating poorer social functioning skills.

The MSCS was originally developed using a sample of 183 adolescents (135 autistic and 48 neurotypical) between the ages of 11 and 18 years old (Yager and Iarocci, 2013). The young adult self-report version of the MSCS, used in the present study, was further validated on a sample of 1,178 neurotypical participants between the ages of 17.5 through 25.5 years old (Tafreshi et al., 2018). Similar to the original MSCS

scale, the CFA of the self-report version demonstrated satisfactory fit indices suggestive of a seven-factor model (SRMR = 0.070; RMSEA = 0.059), providing empirical support for the theoretically-driven construction of the subscales (Tafreshi et al., 2018). Further, fit indices at the subscale-level also all indicated adequate fit for each of the domains (SRMR range = .037 – .077; RMSEA range = .039 – .081).

The Social Responsiveness Scale – Second Edition. The Social Responsiveness Scale – Second Edition (SRS-2; Constantino & Gruber, 2012) consists of 65 items scored on a 4-point Likert-scale, ranging from *not true*, *sometimes true*, *often true*, to *almost always true*. The scale generates scores for five subscales which were theoretically determined by the scale's authors – Social Awareness (AWR), Social Cognition (COG), Social Communication (COMM), Social Motivation (MOT), and Restricted and Repetitive Behavior (RRB) – as well as an overall total score (TOT).

The original Social Responsiveness Scale (Constantino et al., 2003, 2000) was created to establish a brief quantitative measure of the quality of social interactions of children with ASD that could be completed by teachers or parents. The normative sample used to standardize the updated SRS-2 consisted of 4,709 ratings on 1,963 individuals, including 247 preschool children, 1014 school-aged children, and 702 adults. The measure was found to have strong internal consistency, with alpha coefficients for total scores ranging from .94 – .96 for the three age groups (Bruni, 2014), as well as good predictive and concurrent validity (Bruni, 2014; Constantino and Gruber, 2012). SRS scores have been shown to be strongly correlated with algorithm scores from the Autism Diagnostic Interview – Revised (Rutter, LeCouteur, & Lord, 2003), Autism Diagnostic Observation Schedule – Second Edition (Lord et al., 2012)

and the Social Communication Questionnaire (Rutter, Bailey, & Lord, 2003), and have good cross-cultural validation (Bölte et al., 2011, 2008; Constantino, 2003). Raw scores on the SRS-2 Self Report range from 0 to 195, and standardized scores are reported as T-Scores with a mean of 50 and standard deviation of 10, with higher scores indicating a greater degree of symptoms commonly associated with autism.

Procedures

All participants read and signed informed consent forms approved by the university's IRB before participating in the study. After participating in an electrophysiology task, each participant filled out each of the three social competence measures. The electrophysiology task did not include any mention of social functioning or social competence, so it is unlikely that participating in the task primed participants in any way. Participants were welcomed to fill out the three measures in any order that they chose. Pearson's r was calculated for the total scores of each scale as well as for the subscales of each measure.

Results

There was substantial spread of total scores across the three self-report scales (see Figure 1), corroborating previous reports suggesting that social functioning abilities fall along a continuum, regardless of an individual's diagnostic category (Constantino and Todd, 2003; Spiker et al., 2002). On the AQ, Total scores ranged from 0 to 31 (mean = 13.98; SD = 6.58) and were normally distributed (skewness = 0.71; kurtosis = 3.31). The average Total score on the AQ was well below the cutoff of 32, indicating few autism symptoms. On the MSCS, Total scores ranged from 233 to 367 (mean = 311.18; SD = 37.16) and were normally distributed (skewness = -0.32; kurtosis = 2.14). T-scores

for the SRS-2 Total score ranged from 38 to 77 (mean = 50.16; SD = 9.03) and were slightly positively skewed (skewness = 1.19; kurtosis = 3.99).

Figure 1. a) AQ score distribution; b) MSCS score distribution; c) SRS-2 score distribution

Full correlation matrices for each of the scales can be found in Tables 1 – 3.

Total scores for the AQ were strongly correlated with total scores for the SRS-2 ($r = 0.78$, $p < .0001$), replicating previous findings (Nishiyama et al., 2014), and total scores for the MSCS ($r = -0.64$, $p < .0001$). Similar to reports about convergent validity between the MSCS and the SRS (Yager and Iarocci, 2013), the MSCS total scores were strongly correlated with the total scores on the SRS-2 ($r = -0.85$, $p < .0001$). The level and strength of these correlations are very similar to the existing literature, providing further validation of the relations between the total scores on these scales.

Table 1

AQ vs. MSCS Score Correlations

	AQ						MSCS						
	Total	SS	ATSW	ATDE	COMM	IMG	SM	SI	DEM	SK	VCS	NSS	ER
AQ													
SS	0.78****												
ATSW	0.73****	0.48***											
ATDE	0.49***	0.26	0.12										
COMM	0.79****	0.68****	0.55****	0.12									
IMG	0.62****	0.31*	0.36*	0.03	0.42**								
MSCS													
SM	-0.67****	-0.70****	-0.51***	-0.12	-0.61****	-0.42**							
SI	-0.51***	-0.41**	-0.52***	0.10	-0.57****	-.43**	0.66****						
DEM	-0.39**	-0.35*	-0.27	0.04	-0.36*	-0.46**	0.67****	0.48***					
SK	-0.51***	-0.39**	-0.36*	-0.09	-0.55****	-0.40**	0.51***	0.69****	0.47***				
VCS	-0.41**	-0.31*	-0.35*	0.00	-0.52***	-0.29	0.39**	0.59****	0.33*	0.69****			
NSS	-0.53***	-0.45**	-0.33	-0.20	-0.52***	-0.34*	0.64****	0.53****	0.59****	0.49***	0.49***		
ER	-0.48***	-0.34*	-0.52***	0.02	-0.56****	-0.29*	0.38**	0.52***	0.32*	0.63****	0.75****	0.32*	
Total	-0.64****	-0.54****	-0.53****	-0.05	-0.67****	-0.47***	0.79****	0.82****	0.70****	0.81****	0.79****	0.76****	0.74****

Note: p < .0001 '****'; p < .001 '***', p < .01 '**', p < .05 '*'

Table 2

AQ vs. SRS-2 Score Correlations

	AQ						SRS-2				
	Total	SS	ATSW	ATDE	COMM	IMG	AWR	COG	COMM	MOT	RBB
AQ											
SS	0.78****										
ATSW	0.73****	0.48***									
ATDE	0.49***	0.26	0.12								
COMM	0.79****	0.68****	0.55****	0.12							
IMG	0.62****	0.31*	0.36*	0.03	0.42**						
SRS-2											
AWR	0.57****	0.43**	0.40**	0.08	0.64****	0.39**					
COG	0.69****	0.50***	0.48***	0.05	0.78****	.57****	0.73****				
COMM	0.73****	0.65****	0.52***	0.14	0.76****	0.46**	0.72****	0.84****			
MOT	0.72****	0.69****	0.56****	0.16	0.71****	0.34*	0.66****	0.73****	0.87****		
RRB	0.79****	0.66****	0.53***	0.26	0.76****	0.46**	0.62****	0.84****	0.87****	0.80****	
Total	0.78****	0.67****	0.56****	0.15	0.80****	0.49***	0.78****	0.90****	0.97****	0.91****	0.92****

Note: $p < .0001$ '****'; $p < .001$ '***', $p < .01$ '**', $p < .05$ '*'

Table 3

SRS-2 vs. MSCS Score Correlations

	SRS-2						MSCS						
	AWR	COG	COMM	MOT	RBB	Total	SM	SI	DEM	SK	VCS	NSS	ER
SRS-2													
COG	0.73****												
COMM	0.72****	0.84****											
MOT	0.66****	0.73****	0.87****										
RRB	0.62****	0.84****	0.87****	0.80****									
Total	0.78****	0.90****	0.97****	0.91****	0.92****								
MSCS													
SM	-0.50***	-0.64****	-0.75****	-0.83****	-0.65****	-0.77****							
SI	-0.57***	-0.74****	-0.70****	-0.64****	-0.59****	-0.72****	0.66****						
DEM	-0.36*	-0.47**	-0.47**	-0.38*	-0.32*	-0.45**	0.67****	0.48***					
SK	-0.61****	-0.79****	-0.73****	-0.63****	-0.70****	-0.76****	0.51***	0.69****	0.47***				
VCS	-0.64****	-0.72****	-0.65****	-0.56****	-0.71****	-0.71****	0.39**	0.59****	0.33*	0.69****			
NSS	-0.40**	-0.58****	-0.71****	-0.61****	-0.63****	-0.68****	0.64****	0.53****	0.59****	0.49***	0.49***		
ER	-0.52***	-0.66****	-0.54***	-0.48**	-0.63****	-0.61****	0.38**	0.52***	0.32*	0.63****	0.75****	0.32*	
Total	-0.65****	-0.83****	-0.82****	-0.74****	-0.77****	-0.85****	0.79****	0.82****	0.70****	0.81****	0.79****	0.76****	0.74****

Note: p < .0001 (****), p < .001 (***), p < .01 (**), p < .05 (*)

Adding to the previous literature, specific subscales that were theoretically related were also examined for convergent and discriminant validity. A full exploration of each of the subscale combinations can be found in Tables 1 – 3, but as reporting them all is beyond the scope of this brief report, only a subset of comparisons is discussed here. AQ Communication subscale scores and SRS-2 Social Communication scores were strongly correlated ($r = 0.76$, $p < .0001$), suggesting good convergent validity of these dimensions. Similarly, SRS-2 Social Communication scores were strongly correlated with scores on the MSCS Verbal Conversation Skills ($r = -0.65$, $p < .0001$) and Nonverbal Sending Skills, which reflects non-verbal aspects of social communication such as eye contact, facial expressions and tone of voice ($r = -0.71$, $p < .0001$). MSCS Verbal Conversation Skills scores were also significantly correlated with AQ Communication scores ($r = -0.52$, $p < .001$), confirming previous reports of convergent validity between these two subscales (Tafreshi et al., 2018). Scores on the SRS-2 and MSCS Social Motivation subscales were strongly correlated with each other ($r = -.83$, $p < .0001$), again exemplifying strong convergent validity for this dimension of social competency. In line with previous theoretical frameworks of social competence postulating a relationship between social motivation and social skills (Rose-Krasnor, 1997), Social Skills scores on the AQ were strongly correlated with Social Motivation scores on the SRS-2 ($r = 0.69$, $p < .0001$) and the MSCS ($r = 0.70$, $p < .0001$).

The AQ also includes an Attention to Detail subscale that is not theoretically related to social functioning. Scores on this subscale did not correlate with any of the subscales on the SRS-2 or the MSCS, suggesting good discriminant validity for this subscale; however, other subscales not theoretically related to social functioning, for

example, the Restricted and Repetitive Behaviors subscale on the SRS-2, were found to be strongly correlated with many subscales more closely related to social function (e.g., the AQ Communication subscale ($r = .76$, $p < .0001$). Interestingly, scores on the Attention Switching subscale on the AQ were significantly related to total scores on both the SRS-2 ($r = 0.56$, $p < .0001$) and the MSCS ($r = -0.53$, $p < .001$). Attention switching is not commonly conceptualized as an aspect of social functioning; however, this result actually supports previous reports of the relationship between executive function and social communication deficits found in children with (McEvoy et al., 1993) and without (Hutchison et al., 2019; Riggs et al., 2006) autism.

In addition to analyses at the group level, supplemental examination of individual performance revealed that participant's scores tended to be rather stable across the three measures; individuals who had some of the highest total scores on the AQ, also scored higher than 2 standard deviations above the mean on the SRS-2 total score and had relatively lower scores on the MSCS, all indicating lower than average social functioning. For example, Figure 2 highlights in red the scores of two individuals in the sample. The red cross represents scores for one participant whose scores were consistently elevated in terms of social functioning difficulties, whereas the red circle tracks the scores of a participant who scored in the high functioning range across the three measures. Though anecdotal, these observations help to bolster group level analyses in support of the conclusion that individuals perform similarly across these three measures of social functioning.

Figure 2. a) AQ and SRS-2 scores; b) AQ and MSCS scores; c) MSCS and SRS-2 scores

Discussion

Conclusion

Assessing the validity for social functioning scales is critical in both clinical and research settings to ensure that this commonly assessed construct is not only measured accurately, but that studies using different measures can be integrated with reasonable confidence. The current brief report provides a detailed breakdown of the convergent and divergent validity of the self-report forms of the AQ, MSCS, and SRS-2 at the subscale level. These scales were chosen because their form's items adequately address contextual and developmental changes in social competency, they have been shown to be sensitive to variation in social functioning in neurotypical populations, and they include subscales to capture differences in social functioning profiles.

Results showed robust correlations between the total scores for each scale, as well as between theoretically related subscales. Social communication scores, which are commonly referenced in the domain of social function, across all of the scales, were

strongly correlated with each other, suggesting that social communication is assessed similarly across the three scales. Social Motivation scores on the SRS-2 and MSCS were strongly correlated with each other as well as Social Skills scores on the AQ. These relationships provide evidence of strong convergent validity between scales across different dimensions associated with social functioning.

Scales did exhibit some discriminant validity, for instance, Attention to Detail scores on the AQ were not significantly related to any other subscales; however, the Restricted and Repetitive Behaviors subscale on the SRS-2, which is not conceptually related to social functioning was strongly correlated with many subscales more closely related to social function. This is noteworthy given that the sample for the study consisted of typically developing adults. As meaningful profiles of social functioning become more utilized in autism research, it will be increasingly important to analyze the validity of measures at the subscale level to ensure that the scores represent relevant patterns of strengths and weaknesses in an individual.

Beyond strictly convergent and divergent evidence for the validity of specific subscales, we also examined how relations between subscales mapped on to established theories of social functioning. For example, scores on the AQ Attention Switching subscale were moderately correlated with total scores on both the SRS-2 and MSCS, providing evidence of a link between executive function and social communication abilities (Hutchison et al., 2019; McEvoy et al., 1993). Rose-Krasnor's 1997 proposal that social motivation and social skills are related in social competence was also supported by the current results through a strong correlation between AQ Social Skills scores and Social Motivation scores on the SRS-2 and MSCS.

Evidence from individual performance on the scales bolstered the group analysis in that participants tended to have total scores in a similar range across each of the three scales. As the field of autism research continues to move towards more dimensional approaches to the conceptualization of diagnosis, as well as the constructs that define the diagnosis, it will be increasingly important to determine whether measures are sensitive to the entire continuum of social functioning abilities and are able to capture meaningful profiles of social functioning in individuals with and without autism.

Clinical Implications and Future Directions

Given the large number of social functioning scales available to clinicians and researchers, the question remains: How do we select between the different measures? The convergent validity data presented in this article can provide some degree of confidence that the scores from the AQ, the MSCS, and the SRS-2 can be interpreted similarly within and between studies; however, each scale has advantages and disadvantages, which vary based on the context of their use. These advantages and disadvantages are reviewed below, followed by a summary of clinical implications and future directions.

The AQ is one of the most widely used scales in the autism research literature. According to Google Scholar, as of the writing of this article, Baron-Cohen et al. (2001), the original adult self-report version of the AQ, has been cited 4,383 times in the past 20 years. It demonstrates good diagnostic validity (Woodbury-Smith et al., 2005), supporting its use as an autism screener. The AQ was also one of the first brief self-report measure to assess autism traits among adults. Perhaps because of this primacy,

and the fact that the scale is freely available, the AQ enjoys a popularity which continues to perpetuate its momentum in both research and clinical work. Research has supported the reliability (Baron-Cohen et al., 2001) and internal consistency (Austin, 2005; Baron-Cohen et al., 2001) of the AQ; however, factor analyses based on large neurotypical samples of participants have challenged psychometric properties of the original five subscales proposed by the scale's authors, instead supporting a three-factor model based on 26 items of the AQ (Austin, 2005; Hurst et al., 2007). Although our data supported strong correlations between many of the AQ subscales with theoretically-related subscales of the SRS-2 and the MSCS, our sample size was insufficient to conduct an adequately powered factor analysis.

The SRS-2 presents researchers and clinicians with many advantages and disadvantages that are similar to the AQ. Though it was published over a decade after the AQ, the SRS-2 is also widely used in the empirical literature, with 3,065 citations of the second edition. Research regarding the SRS-2 has demonstrated satisfactory psychometric properties, such as strong internal consistency (Bruni, 2014), and predictive and concurrent validity for the School-Age Form (Bruni, 2014; Constantino and Gruber, 2012). The SRS has been translated into languages, including German (Bölte et al., 2008), Taiwanese (Wang et al., 2012), and Farsi (Tehrani-Doost et al., 2018), and demonstrated good cross-cultural validity in each of these samples. Unlike the AQ and the MSCS, the SRS-2 is not free, but it affords the added benefit of a normative sample, with results reported in gender-normed T-scores. T-scores, in contrast to raw scores, allow researchers and clinicians to report how a participant's social functioning score compares to others who are of the same gender and similar

age. Clinicians in particular may find this type of score helpful in psychodiagnostic reports due to its ease of interpretation.

However, additional empirical work is needed to justify the widescale use of the SRS-2. For example, though the School-Age Form demonstrated strong predictive validity (Area under the curve (AUC) = 0.97; Bruni, 2014), other forms did not exhibit as conclusive performance distinguishing participants with ASD from those with other psychiatric diagnoses. (e.g., AUC = 0.72; Mandell et al., 2012). Further, although the scale's authors report good model fit based on a CFA (Constantino and Gruber, 2012; Frazier et al., 2014), this analysis was conducted to provide support for the two-factor model of autism features (Social Communication/Interaction and Restricted Interests and Repetitive Behaviors) rather than to examine the underlying factor structure of the SRS-2 and its subscales. Subsequent Exploratory Factor Analyses (EFA's) of the SRS-2, completed by independent investigators have supported a four-factor solution (Nelson et al., 2016).

The MSCS is one of the newest social functioning assessments in the autism research literature, created specifically to investigate individual differences in social competence in autistic and nonautistic individuals. In contrast to the AQ and the SRS-2, the MSCS subscales were developed from the outset based on a combination of theory and empirical validation. CFA analyses of both the parent-report (Yager and Iarocci, 2013) and self-report (Tafreshi et al., 2018) versions of the MSCS have provided evidence for the seven subscales of the MSCS and multidimensional structure of social competence that the authors propose in their theoretical framework. Our data further lend evidence supporting the use of the MSCS, providing convergent validity with

relevant subscales of scales which are generally more widely used in the autism research literature.

In sum, the data support the use of the AQ, SRS-2, and MSCS through providing convergent validity on the most recent versions of the scales. The findings lend support to the notion that social functioning is comprised of multiple related domains that are meaningfully related to each other. The AQ and the SRS-2 each enjoy robust use in the empirical literature, which likely increases their use within clinical contexts as well. While the AQ is available free-of-charge, making it accessible to a wide range of clinicians who might otherwise not be able to purchase social functioning scales, the SRS-2 affords within-gender comparisons through its reporting of scaled t-scores in addition to raw scores. Such scaled scores allow for greater dimensionality within the construct of social functioning and may be more useful than categorical cut-off scores in both research and psychodiagnostic testing.

Both the AQ and the SRS-2, however, have more empirical support for using their total scores rather than relying on specific subscales. The MSCS provides a significantly stronger evidence base for the social functioning dimensions specified in its subscales. Although our data support strong correlations between the subscales on the MSCS and theoretically related subscales of the AQ and SRS-2, additional research is required to independently evaluate the factor structures of these scales in both clinical and non-clinical populations. As such, the MSCS is likely the strongest measure to provide clinicians with meaningful characterizations of an individual's profile of strengths and challenges in terms of their social functioning abilities. Such profiles allow clinicians

to tailor social functioning interventions, which may improve intervention effectiveness (Rao et al., 2008; Uljarević et al., 2020).

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