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Research Article

Psychometrics of the Pragmatic Rating Scale for School-Age Children With a Range of Linguistic and Social Communication Skills

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Purpose: Social communication or pragmatic skills are continuously distributed in the general population. Impairment in these skills is associated with two clinical disorders, autism spectrum disorder (ASD) and social (pragmatic) communication disorder. Such impairment can impact a child's peer acceptance, school performance, and current and later mental health. Valid, reliable, examiner-rated observational measures of social communication from a semistructured language sample are needed to detect social communication impairment. We evaluated the psychometrics of an examiner-rated measure of social (pragmatic) communication, the Pragmatic Rating Scale–School Age (PRS-SA).
Method: The analytic sample consisted of 130 children, ages 7–12 years, from five mutually exclusive groups: ASD (n = 25), language concern (LC; n = 5), ASD + LC (n = 10), social communication impairment only (n = 22), and typically developing (TD; n = 68). All children received language and autism assessments. The PRS-SA was rated separately using video-recorded communication samples from the Autism Diagnostic Observation Schedule. Assessment data were employed to evaluate the psychometrics of the PRS-SA. Analysis of covariance models were used to assess whether the PRS-SA would detect differences in social communication functioning across the five groups.
Results: The PRS-SA demonstrated strong internal reliability, concurrent validity, and interrater reliability. PRS-SA scores were significantly higher in all groups compared to the TD group and differed significantly in most pairwise comparisons; the ASD + LC group had the highest (more atypical) scores.
Conclusions: The PRS-SA shows promise as a measure of social communication skills in school-age verbally fluent children with a range of social and language abilities. More research is needed with a larger sample, including a wider age range and geographical diversity, to replicate findings.
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Social (pragmatic) communication involves the use of linguistic and nonlinguistic behaviors in socially dynamic contexts to convey messages specifically constructed to achieve a speaker's intended purpose (Prutting, 1982). Social communication characteristics are quantitative traits that are rather normally distributed in the general population (Constantino & Todd, 2003). Even mild variations from the norm in social communication skills may result in significant functional impairment in forming and sustaining peer relationships for youth with and without autism spectrum disorder (ASD; Timler, 2018). Social communication skills in school-age children are related to likeability (Place & Becker, 1991), emotional and behavioral profiles (Helland & Helland, 2017), bullying, and mental health in later life (Whitehouse et al., 2009). These difficulties highlight the importance of detecting and treating social communication impairment as soon as possible in school-age children who may have missed earlier identification (Whitehouse et al., 2009). One research-based measure of social (pragmatic) communication functioning, the Pragmatic Rating Scale–School Age (PRS-SA; Greenslade

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et al., 2019), may have promise for detecting social (pragmatic) communication impairment but requires psychometric assessment. This study examines psychometric properties of the PRS-SA in a sample with diverse linguistic and social communication skills during middle childhood.

Social (pragmatic) communicative competence is a complex interplay between social and cognitive knowledge, ability to produce well-formulated linguistic utterances, and successful tailoring of linguistic and nonlinguistic content and form to the social and linguistic context (Prutting, 1982). Pragmatics, which has its theoretical roots in philosophy (Pierce, 1878) and linguistics (e.g., Grice, 1975), refers to the rules that govern social use of language, including discourse management (Grice, 1975), presupposition (Stalnaker, 1978), and speech acts (Austin, 1962; Searle, 1969; Wittgenstein, 1958). It also encompasses aspects of linguistic (e.g., nonliteral language, multiple-meaning words) and nonlinguistic (e.g., gesture, facial expression, prosody) communication that impact the quality of social communicative exchanges. All of these domains are represented in the PRS-SA.

Numerous studies have focused on identifying differences in social communication functioning in children with developmental language disorder (DLD; S. L. Bishop et al., 2017), social (pragmatic) communication disorder (SCD; American Psychiatric Association [APA], 2013), and ASD (APA, 2013). DLD, not specified in the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (*DSM-5*; APA, 2013), is defined as impairment in one or more of the following: phonology, morphology, syntax, semantics, and pragmatics (S. L. Bishop et al., 2017). Diagnostic criteria for SCD and ASD include impairment in use of verbal and nonverbal communication, but only ASD includes criteria for restricted and repetitive patterns of behavior, interests, or activities (APA, 2013). All three of these disorders are prevalent in the population. Language disorders, as defined by the Children's Communication Checklist–2 (CCC-2; D. V. Bishop, 2003), occur in about 11% of 4- to 5-year-olds (Norbury et al., 2016). Although prevalence studies of SCD per se are lacking, the prevalence of pragmatic language impairment was 7.5% in a community sample of nearly 1,400 kindergarteners (Ketelaars et al., 2009). In individuals with language disorders, prevalence rates of pragmatic impairment are higher, ranging from 23% to 33% (Ketelaars et al., 2009). ASD affects one in 54 children (Maenner et al., 2020). Given the prevalence of pragmatic impairment (hereafter, social communication impairment) across these disorders and the impact of such impairment on short- and long-term functioning, the importance of identification and treatment of social communication impairment cannot be overstated. In clinical practice, however, social communication skills are rarely the first line of skills assessed (Timler, 2018). As a consequence, social communication impairment may be missed in children with or without language impairment (Davies et al., 2016). Identifying social communication impairment during childhood would afford access to appropriate intervention, ultimately improving outcomes, including school success, friendship building, psychosocial well-being, and employability.

Clinical assessment of social communication behavior must consider four domains (Roth & Spekman, 1984): speech acts (communicative intentions such as greeting, informing), discourse management (e.g., segues between topics, turn length), presupposition (e.g., providing sufficient information for the listener to infer meaning, tailoring the formality to the relationship), and nonverbal communication-related skills (e.g., gestures, eye contact, vocal tone). These domains are integrated into the diagnostic criteria for SCD and ASD, which are characterized by social communication impairment (see Supplemental Material S1).

A variety of social communication assessment approaches and tools are available. The primary approaches include informant report, formal direct assessment, and structured observation (Norbury, 2014). A systematic review of the literature identified nine social communication measures (one interview, three direct assessments, five informant report questionnaires) that are appropriate for use with verbal school-age children (Yuan & Dollaghan, 2018). Of these measures, only one, the CCC-2, had at least one item pertaining to each of the four domains identified in the *DSM-5* as defining characteristics of SCD. The CCC-2 is an informant (teacher, parent) report measure, considered a valid comprehensive communication screener. To examine the relation between a child's pragmatic and structural language competencies, the CCC-2 provides for the calculation of a Social Interaction Deviance Composite (SIDC). A negative score indicates that social communication deficits exist above and beyond structural language deficits. While this is well conceived, Norbury et al.'s (2004) large *n* study revealed that SIDC scores were continuously distributed and did not distinguish children with specific language impairment, SCD, or ASD. Another widely used informant report measure is the Social Responsiveness Scale–Second Edition (SRS-2; Constantino & Gruber, 2012). While the SRS-2 is designed to identify the presence and severity of social impairment within the autism spectrum, it reliably assesses social communication traits within the general population (Constantino & Todd, 2003) and includes a subscale focusing on social communication behavior (Constantino & Gruber, 2012). In a study of SCD in first-degree relatives of an individual with ASD and with language impairment, the SRS-2 Social Communication Index (SCI) *T* score was comparable to a formal direct assessment of social communication, the Comprehensive Assessment of Spoken Language (CASL; Carrow-Woolfolk, 1999; Nonliteral Language and Pragmatic Judgment scales) in identifying SCD (Flax et al., 2019).

Informant report measures are of considerable value in assessing social communication behavior in natural environments. Yet, several limitations exist. One pertains to the quality of informant–child relationship. Even in parent–child relationships with the highest rated quality, there are increasing disagreements between parent report and child self-report of child traits with increasing child age (Quitmann et al., 2016). Furthermore, the reliability of parental report

of child characteristics may vary by parent socioeconomic status, maternal education, and child behaviors (Moody et al., 2017). In preschoolers with language delays, McCabe and Marshall (2006) found only low to moderate correlations between teacher and parent observations, suggesting that, in children with developmental concerns, reliability of reporting may be variable. Additionally, parents and even self-reporters of social skills may not have the training to identify specifics of the social communication errors that are contributing to social difficulties. In ASD specifically, there may be a difference between clinicians and parents in the knowledge of skills and skill application expected in typical conversational behavior occurring within dynamic naturalistic communicative exchanges (Klin et al., 2005). Additionally, accurate ratings of children's social communication skills are challenging for lay raters, especially with children with unclear diagnoses (Grzadzinski et al., 2016).

An alternative approach to measuring social communication skills is through the use of formal direct assessment tools (see reviews by Norbury, 2014; Timler & Covey, 2021). Here, we mention only such assessment tools that detected a difference in performance of children with DLD, SCD, or ASD by more than 1 *SD* from the mean of typically developing (TD) children (Timler & Covey, 2021). The best performing measure was the CASL-2 (Carrow-Woolfolk, 2017), normed for children ages 3 years to 21 years 11 months. The CASL-2 has six subtests and provides a Supralinguistic Index score. This measure focuses on comprehension of idioms, nonliteral language, and double meaning language; inferencing; and stating pragmatic language rules for hypothetical situations. The CASL-2 detected more than 1 *SD* from the TD mean for developmental groups with DLD, SCD, and ASD. Other formal direct assessment tools performed as follows in distinguishing the abovementioned groups. The Clinical Evaluation of Language Fundamentals–Fifth Edition (Wiig et al., 2013) and Social Emotional Evaluation (Wiig, 2008) for ages 10 years to 12 years 11 months distinguished DLD and ASD groups from a TD group. The Diagnostic Evaluation of Language Variation–Norm Referenced (Seymour et al., 2005) distinguished TD and DLD groups. The Receptive, Expressive & Social Communication Assessment–Elementary (Hamaguchi & Ross-Swain, 2015) and Test of Integrated Language and Literacy Skills (Nelson et al., 2016) differentiated only an ASD group from a TD group. These measures differed in the variety of social communication domains assessed but mostly focused on nonliteral language and inferential skills; none assessed discourse management skills.

Although formal direct assessments of social communication performance provide standardized stimuli that specifically examine certain types of social communication–related skills, they have inherent limitations due to the contextual dependency and dyadic nature of social communication (Bacon et al., 2019; Norbury, 2014). In particular, such assessments constrain the dynamic variation of events that occur within dyadic exchanges where communicative partners must apply their tacit knowledge of pragmatic rules to generate appropriate social communication behavior (Volden et al., 2009), thus limiting observation of a child's discourse management, presuppositional skills, diversity of illocutionary acts, or nonlinguistic behaviors related to social communication. Indeed, even children with ASD may not score outside the normal range on a formal direct assessment of social communication despite parent and teacher reports of substantial challenges in social interaction and peer relationships (Timler, 2014; Volden & Phillips, 2010). The limitations of formal direct assessment tools may be largely mitigated through semistructured (Prutting, 1982) or structured observation (Norbury, 2014) where a more dynamic, conversational interaction provides the context for assessing social communication behavior (Norbury, 2014; Timler & Covey, 2021).

Observational approaches differ in the degree of granularity with which children's social communication behavior is documented. For example, the Analysis of Language Impaired Children's Conversation (D. V. Bishop & Adams, 1989) employs a granular approach, providing a coding schema for discourse participation, conversational dominance, assertiveness, verbosity, responsiveness, and meshing (appropriateness of responses). Another granular approach was employed by Martin et al. (2018), using operationally defined coding schema to identify frequency, duration, and quality of communicative behavior in a conversational sample. A more rapid method, yielding less detailed information, is to employ examiner-rated scales such as the Yale In Vivo Pragmatic Protocol (Simmons et al., 2014), which provides probes within a semistructured conversational exchange for discourse management, communicative function, conversational repair, presupposition, and register. One limitation of the Yale In Vivo Pragmatic Protocol is the lack of evidence that it distinguishes children with social communication impairment from TD children (Norbury, 2014). A valid and reliable examiner-rated observational measure is needed that can identify social communication impairment. In this study, we examine the promise of the PRS-SA for addressing this need.

The PRS-SA is an examiner-rated observational measure that offers a dimensional and developmental approach to characterizing social communication skills of school-age children and teens (adapted from an adult measure of social communication; Landa et al., 1992) with or without known developmental disability, including ASD (e.g., Klusek et al., 2014). PRS-SA items align with the *DSM-5* criteria for SCD as shown in Supplemental Material S1 and are rated from a semistructured social conversational sample between the child and an examiner trained to reliability in rating the PRS-SA items. Such conversation samples allow for observation and characterization of subtle components of social interaction, such as discourse management, presuppositional skills, and more. In a longitudinal study, the PRS-SA differentiated 8- to 12-year-olds whose grouping (TD, social communication delayed, ASD) had been defined at age of 3 years (Greenslade et al., 2019) but psychometric data are lacking.

In the original PRS-SA (Greenslade et al., 2019), a 3-point scale was used to rate each item, requiring considerable discernment to decipher the nuances distinguishing

ratings of 0, 1, or 2. While the 3-point scale generated a continuous variable, a categorical-type rating was connoted, where "0" represented *generally appropriate social communication behavior*, "1" represented *a slight variation from the norm*, and "2" represented *a clear departure from the norm*. To align the rating system with the dimensional nature of social communication, we replaced the 3-point rating scale with a 7-point Likert scale and, for the first time, examine the 7-point scale in this article. A 7-point scale would permit rating of more subtle gradients in typicality (or departures therefrom) than are afforded with a 3-point scale (Graham et al., 2012). Following the scale model of Adamson et al. (2016), anchors are provided for scores of 1, 4, and 7.

The main aim of this article is to evaluate the psychometrics of the PRS-SA, revised for use of a 7-point scoring system, in a middle childhood sample with diverse social and language abilities. A secondary aim was to examine whether this PRS-SA version differentiated overall social communication functioning across groups operationally defined by their social and linguistic functioning.

Method

Participants

The 130 participants (57.4% male), aged 7–12 years (M = 9.31, SD = 1.60), were recruited from three participant pools: a prospective longitudinal study of children at high or low familial risk for ASD, previously diagnosed with ASD, and a cross-sectional sample of children recruited from the community and from an outpatient clinical setting. Twenty of these participants had been included in the Greenslade et al. (2019) study. Inclusion criteria for this study included being between ages 7 and 12 years, a native English speaker, having fluent speech (e.g., met criteria for receiving Module 3 of the Autism Diagnostic Observation Schedule [ADOS-G; Lord et al., 2000] or ADOS-2; Lord et al., 2012), and having no missing data on our two primary measures, Test of Language Development (TOLD; Hammill & Newcomer, 2008; Newcomer & Hammill, 2008) or ADOS (Lord et al., 2000, 2012). Exclusionary criteria included birth weight of < 1,500 g, severe birth trauma, head injury, prenatal illicit drug or excessive alcohol exposure, and severe birth defects or a known genetic disorder related to autism (e.g., fragile X syndrome). Details about recruitment and proband ASD diagnosis are described in (Greenslade et al., 2019). See Table 1 for demographic information. Informed consent and assent were obtained for all participants. This study has been reviewed and approved by the institutional review board.

Measures

ADOS

The ADOS (ADOS-G [Lord et al., 2000] and ADOS-2 [Lord et al., 2012]) is a semistructured, examiner-administered assessment of autism-related behaviors. All participants in the study received Module 3, intended for individuals with fluent language. ASD classification is based on algorithm scores across Social Affect and Restricted Repetitive Behaviors domains. Examiners administering the ADOS were research reliable, were employed in an autism specialty center, had at least 2 years of autism experience, and held advanced degrees (master's or doctoral degrees) in psychology or speech-language pathology. ADOS data were used by the examiner who performed the comprehensive assessment as part of the process of determining clinical best estimate (CBE) of ASD (see below) and for examining concurrent validity of the PRS-SA.

Our use of the ADOS to examine concurrent validity of the PRS-SA was based on reports that the ADOS Social Communication domain yields data relevant to social (pragmatic) communication functioning. For example, Foley-Nipcon et al. (2017) examined whether participants (ages 5.5–17.8 years) who met ASD diagnostic criteria when using both the ADOS and Autism Diagnostic Interview–Revised (Rutter et al., 2003), but not based on ADOS Module 3 alone, would meet *DSM-5* criteria for SCD. Although the ADOS algorithm lacks an item addressing the *DSM-5* SCD A4 criterion, the percentages of such participants meeting other SCD criteria were as follows: 89% met Criterion A1, 89% met Criterion A2, and 100% met Criterion A3 (Foley-Nipcon et al., 2017). Another research group concluded that the ADOS Module 3 Social Communication domain score provides a good representation of adolescents' (ages 8–12 years) social communication behavior based on its strong prediction of reciprocal social communication behavior in peer-to-peer naturalistic interactions (Qualls & Corbett, 2017).

For the concurrent validity analysis, we used the ADOS Calibrated Severity Score Social Affect (CSS SA), which provides comparability across ADOS modules and the two versions of the ADOS (ADOS-G and ADOS-2). The CSS SA ranges from 1 to 10; higher scores reflect greater ASD symptom severity (Hus et al., 2014). Test–retest reliability for the CSS SA for Module 3 is .782 (Choi, 2019).

TOLD

Participants received the primary (TOLD-P:4, ages 4–8.9 years; Newcomer & Hammill, 2008) or intermediate (TOLD-I:4; ages 9–17.9 years; Hammill & Newcomer, 2008) version as appropriate. Both versions are composed of six subtests to measure: Sentence Imitation/Sentence Combining, Syntactic Understanding/Word Order, Morphological Completion/Morphological Comprehension, Picture Vocabulary, Relational Vocabulary, and Oral Vocabulary/Multiple Meanings, which may be combined into a summary score, the Spoken Language Index (SLI). Both TOLD versions generate the same composites, normed to the same scale. Therefore, TOLD scores are comparable across the full age range of the sample. Per the manual, internal consistency is 71.4, test–retest reliability is 72.4, and content validity is 57.1. The TOLD SLI score was used to determine presence or absence of language concerns

Table 1. Sociodemographic characteristics of participants.

Characteristic	TD (n = 68)	ASD (n = 25)	ASD + LC (n = 10)	LC (n = 5)	SCIO (n = 22)	Total (n = 130)
			M (*SD*)			
Age (months)	106.55 (13.06)	126.48 (28.34)	116.34 (13.54)	118.55 (18.47)	107.52 (16.47)	111.76 (19.19)
			n (%)			
Sex (male)	31 (45.6)	19 (76.0)	8 (80.0)	3 (75.0)	13 (59.1)	74 (57.4)
Mother's education						
High school	0 (0.0)	1 (4.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.8)
Some college	4 (5.9)	5 (20.0)	2 (20.0)	0 (0.0)	3 (13.6)	14 (10.8)
Bachelor's degree	27 (39.7)	10 (40.0)	4 (40.0)	3 (60.0)	7 (31.8)	51 (39.2)
Some graduate	1 (1.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.8)
Graduate degree	35 (51.5)	8 (32.0)	3 (30.0)	1 (20.0)	11 (50.0)	58 (44.6)
Race						
American Indian/Alaska Native	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (4.8)	1 (0.8)
Asian	3 (4.5)	3 (12.5)	1 (11.1)	0 (0.0)	0 (0.0)	7 (5.6)
Black/African American	2 (3.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (4.8)	3 (2.4)
Multiracial	0 (0.0)	3 (12.5)	1 (11.1)	0 (0.0)	1 (4.8)	5 (4.0)
White	62 (92.5)	18 (75.0)	7 (77.8)	4 (100.0)	18 (85.7)	109 (87.2)

Note. TD = typically developing; ASD = autism spectrum disorder; ASD + LC = autism and language concern; LC = language concern (no ASD); SCIO = social communication impairment only.

(LCs) for purposes of grouping participants and to assess concurrent validity.

SRS

The SRS and the SRS-2 (Constantino & Gruber, 2005, 2012; hereafter, SRS) are 65-item informant report measures of five domains of child behavior: Social Awareness, Social Cognition, Social Communication, Social Motivation, and Restricted Interests and Repetitive Behavior. Higher scores indicate greater degree of social impairment. The SRS is normed for children aged 4–18 years and has been validated for use with TD individuals, individuals with ASD, and children having subclinical traits of autism and other developmental disorders. The SRS-2 has been used to identify social communication impairments in individuals with diverse language abilities (ASD, SCD, and language impairment). The SRS SCI T score and the CASL Nonliteral Language and Pragmatic Judgment scales were comparable in identifying social communication impairment (Flax et al., 2019). A subsample of our participants had parent-completed SRS/SRS-2 (n = 73, M_{age} = 109.67 months, SD = 17.96) to assess convergent validity. We specifically focused on the SCI T score given Flax et al.'s (2019) findings.

PRS-SA

The PRS-SA (Landa et al., 1992; Greenslade et al., 2019) was designed to measure social (pragmatic) communication skills in school-age children with at least phrase-level expressive language. It consists of 23 primary items focused on specific social communication behaviors, along with five summary items. The 23 primary items provide a means of assessing speech acts (including social communicative intents, such as greeting and sharing information, related to the *DSM-5* SCD Criterion A1), presupposition (including inferencing; aligned with SCD Criteria A2 and A4), discourse management (aligned with SCD Criterion A3), and nonverbal communication (aligned with SCD Criterion A4). To more adequately reflect the dimensional nature of social communication, the PRS-SA rating system was shifted from a 3- to a 7-point Likert-type scale (1–7) for item-level scoring for this study. Scoring anchors were set at 1 = *no concerns*, 4 = *noticeable variation from the norm but not clinically significant*, and 7 = *clinically significant variation from the norm, significantly impeding effective communication*. PRS-SA total score was calculated by summing ratings for the 23 primary behaviors (possible range of 23–161) where higher scores indicated greater social communication difficulties.

As in prior publications using the PRS-SA, ratings were based on communication samples from the ADOS; however, these ratings were made independently from ADOS scoring. The PRS-SA items, their operational definitions, and item-level rating schemes differ from those of the ADOS. Use of the ADOS as a sampling method for observational rating of social communication functioning has been endorsed by social communication researchers (e.g., Norbury, 2014; Qualls & Corbett, 2017). Archived ADOS video recordings were used to rate the PRS-SA. PRS-SA raters were master's or doctoral level psychologists trained to reliability by first completing a didactic training on the PRS-SA items with video examples (conducted by a speech-language pathologist), completing consensus ratings with archived video recordings of ADOS assessments, then achieving ≥ 80% interrater reliability with the "gold-standard" rater (a doctoral level speech-language pathologist) on four out of five consecutive archived ADOS video recordings of different children. PRS-SA raters were blinded to children's ADOS scores, the CBE of ASD+/− generated at the comprehensive assessment (described below), and TOLD scores. For the 14% of participants where the examiner completing

the comprehensive evaluation (and scored the ADOS) and also rated the PRS-SA, a minimum of 2 months elapsed between events (range: 2 months to 11 years).

Social Communication Impairment Rating

Immediately after completing the PRS-SA, PRS-SA raters evaluated presence/degree of social communication impairment using a 3-point scale, where 0 indicated *developmentally appropriate behavior*, 1 indicated *social communication difficulties but not clearly abnormal*, and 2 indicated *clinically significant social communication impairment*. Codes of "0" and "1" were collapsed into a category of "no social communication impairment." A "2" served as the criterion for classification as social communication impairment. This rating did not contribute to the PRS-SA total score (described above). Raters did not have access to the information needed (e.g., age of onset of concerns about social communication impairment, medical records) to determine whether children rated as a "2" met *DSM-5* criteria for SCD.

Sample Groups Criteria

All participants completed a comprehensive assessment, including the ADOS, language (TOLD), and cognitive testing by a master's or doctoral level psychologist or speech-language pathologist who had attained research reliability on the ADOS and had at least 2 years of autism diagnostic experience. Each child was assessed by a single examiner. The PRS-SA was later rated using the communication sample from archived ADOS video recordings completed as part of each participant's comprehensive assessment. Using data obtained from the comprehensive assessment, along with the Social Communication rating that was made by the PRS-SA rater, five groups were generated: ASD (n = 25), ASD + LC (n = 10), LC (n = 5), social communication impairment only (SCIO; n = 22), or TD (n = 68). Criteria for the ASD group classification (n = 35) included meeting the ADOS criteria for ASD or autism and the *DSM-IV* or *DSM-5* criteria for ASD and having a CBE of ASD as determined by the examiner who administered the ADOS as part of the comprehensive assessment. ASD CBE considered the child's ADOS, cognitive, developmental, and behavioral testing data. Criteria for LC included scoring > 1 *SD* below the mean (< 85) on the TOLD SLI (see Flax et al., 2019). Children meeting criteria for LC but not meeting criteria for ASD (described above) were placed in the LC group. Children with ASD who also met criteria for LC were placed in the ASD + LC group. Criteria for the SCIO group classification included receiving a rating of social communication impairment by the rater of the PRS-SA but not meeting criteria for ASD or LC. The TD group classification required not meeting the above criteria for ASD, LC, or social communication impairment and having no other known developmental disorders.

Statistical Analysis

Our article proposes, first, to evaluate the psychometrics of the PRS-SA. Internal consistency was examined using Cronbach's alpha and item–rest correlations. Concurrent validity was examined via a series of correlations comparing PRS-SA total scores with other measures of child social communication and language functioning. To assess group differences, an analysis of covariance (ANCOVA) was employed to compare operationally defined groups (see above) on total PRS-SA score, adjusting for child age and sex.

Results

PRS-SA Psychometrics

PRS-SA Reliability

Four raters previously trained to reliability (> 80% agreement with reliable ratings on four of five consecutive training videos) rated the PRS-SA using the archived ADOS communication samples. All raters had graduate degrees (master's or doctorate) in psychology and expertise in autism and related disorders and were trained to ≥ 80% reliability (as described above). For the current sample, item-level interrater agreement on the 7-point scale was achieved if raters' scores were within 1 point of each other (i.e., being 1 point above or below the "primary" rater's score for a given item; Adamson et al., 2016). A random sample of 28 (21.5% of the sample) video recordings was selected by an independent data manager for assessing interrater reliability. Average weighted kappa of .831 (range: .4917–1.00) and average percent agreement of 96.36% (range: 88.96–100.00) were obtained. In two instances, raters' kappa coefficients fell below .50. In these cases, the children exhibited low variability in item scores (e.g., nearly all items had been scored 1). When there is a limited range of item-level scores such as this, disagreement between raters negatively impacts kappa despite nearly perfect item-level agreement in scoring. Thus, percent agreement on scores was also considered. Percent agreement was always > 88%.

Comparison of 3- and 7-Point PRS-SA Versions

Twenty children (M = 10.17 years, SD = 2.66) from the present sample had prior PRS-SA scores based on the original 3-point scale (rated by previously trained and reliable raters who differed from raters who used the 7-point scale) and were participants in the Greenslade et al. (2019) study. Raters using the 7-point scale were blinded to PRS-SA 3-point scale ratings. Comparison of PRS-SA total scores using the 7- and 3-point rating scales yielded Pearson correlation of r = .871, p < .001, indicating a very strong relation between PRS-SA versions.

Internal Consistency

A measure of internal consistency and reliability was conducted on the 23 primary PRS-SA items. Cronbach's alpha of .939 indicated a high level of interitem relatedness. The alpha was not improved with the removal of any item, so all items were retained in further analyses. Item–rest correlations ranged from .37 to .76 (see Supplemental

Material S2). This range is not surprising given the diversity of skills that contribute to social (pragmatic) communication competence (e.g., linguistic, inferencing, nonverbal communication, discourse management).

Concurrent Validity

To assess concurrent validity, a Pearson correlation was conducted between children's PRS-SA total score and SRS SCI *T* score. The significant positive correlation (r = .559, $p < .001$) indicates a moderate relation between social communication skills as measured by the examiner-rated PRS-SA and parent-rated child social communication skills on the SRS.

As an additional measure of concurrent validity, a Spearman rank-order correlation test was conducted using children's total PRS-SA score and ADOS CSS SA score (r = .694, $p < .001$), indicating a moderate relation between the PRS-SA and a standardized measure of ASD social communication symptoms.

The Pearson correlation test between PRS-SA total score and the TOLD SLI identified a weak to medium significant negative relation ($r = -.398$, $p < .001$). Higher TOLD scores indicate higher levels of language performance, whereas higher PRS-SA scores indicate more atypical social (pragmatic) communication performance.

Group Analysis

ANCOVA by Language Level and ASD Status

Unadjusted scores for the PRS-SA (total score), TOLD (SLI score), ADOS CSS SA, and SRS SCI *T* score are shown in Table 2. An ANCOVA conducted to compare group's social communication (pragmatic) functioning, measured by total PRS-SA score, covarying for chronological age and child sex, was significant, $F(4, 122) = 52.15$, $p < .001$, $\eta_p^2 = .631$. Given the small sample sizes of the two groups with LC, this analysis was exploratory.

Bonferroni post hoc tests were conducted for group comparisons (see Table 3). The TD group (M = 53.7, SD = 13.61) had significantly ($p < .005$) lower (less impairment) PRS-SA scores than all other groups (means ranging from 76.7 to 100.8; see Table 2). The ASD group (M = 90.2, SD = 14.5) differed significantly from the TD group only, with greater scores on the PRS-SA, as expected ($p < .001$). The SCIO group (M = 84.9, SD = 13.37) had significantly higher scores than the TD group ($p < .001$), but significantly lower PRS-SA scores than the ASD + LC group (M = 100.8, SD = 13.5, p = .024). The LC group (M = 76.7, SD = 13.32) had significantly higher scores than the TD group (p = .012), but significantly lower scores than the ASD + LC group (M = 100.8, SD = 13.5, p = .026). The ASD + LC (M = 100.8, SD = 13.5) group had the highest level of social communication impairment, as measured by the PRS-SA, scoring significantly higher than the TD ($p < .001$), LC (p = .026), and SCIO (p = .024) groups. A density plot of PRS-SA total scores, within each group, is shown in Figure 1, with lines indicating the mean and standard deviation of the PRS-SA for the TD group. Just under half (two of five) of the LC group, 92% of the ASD group, 100% of the ASD + LC group, and 86% of the SCIO group had PRS-SA scores more than 1 *SD* above the TD mean.

Discussion

While variation in social communication skills is naturally occurring in the general population, disruption in social communication functioning can indicate a clinical impairment, seen in ASD and SCD (APA, 2013). We evaluated an examiner-rated observational tool, the PRS-SA, to measure dimensions of social (pragmatic) communication functioning in a sample of school-age children with a range of linguistic and social communication functioning (including children with and without ASD and children with and without LCs based on standardized language assessments). Interrater reliability for the scale was high, supporting usability. The PRS-SA demonstrated strong internal consistency as a unified scale. Evidence for concurrent validity was obtained using other measures of social communication functioning (ADOS CSS SA and SRS SCI) and a measure of structural language functioning (TOLD SLI). As expected from the literature on social communication

Table 2. Language and autism symptom results by participant groups, unadjusted means.

Variable	TD (n = 68)	ASD (n = 25)	ASD + LC (n = 10)	LC (n = 5)	SCIO (n = 22)	Total (n = 130)
			M (*SD*)			
PRS-SA total	54.21 (13.36)	90.16 (17.1)	102.9 (8.61)	78.24 (16.97)	86.55 (15.10)	71.21 (23.31)
TOLD-SLI score	108.21 (9.22)	100.56 (10.78)	68.30 (10.62)	82.04 (2.16)	106.74 (12.36)	102.60 (14.99)
ADOS CSS SA	2.44 (1.91)	6.07 (1.91)	7.17 (2.04)	2 (1.41)	5.23 (2.62)	4.15 (2.73)
SRS SCI *T* score	46.3 (9.22)	69.5 (12.08)	64.4 (12.48)	53.2 (17.31)	63.14 (22.78)	54.55 (15.81)
			n (%)			
Has SRS	40 (58.82)	16 (64.00)	5 (50.00)	5 (100.00)	7 (31.8)	73 (58.8)

Note. As only a subsample had completed SRS data, the sample size (n) and % are provided for that measure. All other measures, data were available for the full sample. TD = typically developing; ASD = autism spectrum disorder; ASD + LC = autism and language concern; LC = language concern (no ASD); SCIO = social communication impairment only; PRS-SA total = Pragmatic Rating Scale–School Age total score; TOLD-SLI score = Test of Oral Language Development Spoken Language Index score; ADOS CSS SA = Autism Diagnosis Observation Schedule Calibrated Severity Score Social Affect; SRS SCI *T* score = Social Responsiveness Scale Social Communication Index *T* score.

Table 3. Communication and autism spectrum disorder symptom results by participant groups, adjusted means.

Variable	TD (n = 68)	ASD (n = 25)	ASD + LC (n = 10)	LC (n = 5)	SCIO (n = 22)
			M (*SD*)		
PRS-SA total	53.7 (13.61)	90.2 (14.5)	100.8 (13.5)	76.7 (13.32)	84.9 (13.37)
TOLD-SLI score	107.7 (10.31)	102.1 (11)	69.2 (10.25)	82.8 (10.1)	107.3 (10.13)
ADOS CSS SA	2.6 (2.19)	5.55 (2.43)	7.01 (2.11)	1 (2.09)	5.2 (2.1)
SRS SCI *T* score	46.3 (13.41)	69.4 (13.68)	64.5 (12.88)	54 (12.82)	63.2 (12.75)

Note. Means adjusted for child age and sex. TD = typically developing; ASD = autism spectrum disorder; ASD + LC = autism and language concern; LC = language concern (no ASD); SCIO = social communication impairment only; PRS-SA total = Pragmatic Rating Scale–School Age total score; TOLD-SLI score = Test of Oral Language Development Spoken Language Index score; ADOS CSS SA = Autism Diagnosis Observation Schedule Calibrated Severity Score Social Affect; SRS SCI *T* score = Social Responsiveness Scale Social Communication Index *T* score.

(Ketelaars et al., 2009), there is some overlap of language impairment and social communication impairment, but not to a large degree, as indicated by the weak to medium relation between a child's overall language and social communication skills (in a sample of verbally fluent children and adolescents).

Results suggest promise for the viability of the PRS-SA as a clinical measure of social communication. Indeed, with the exception of the LC group, which consisted of only five children, the distribution of PRS-SA scores for all other clinical groups largely fell more than 1 *SD* above the TD mean, indicating that the PRS-SA total score allows identification of children with social (pragmatic) communication impairments among a middle childhood sample with a range of social communication and language functioning. Social communication impairment may exist independently of ASD (APA, 2013) and independently of formal linguistic impairment (Timler, 2018). Twenty-two (16.9%) children in our sample had a social communication impairment, without the presence of ASD or LC, suggesting they may otherwise be overlooked for assessment and the possible benefits of a social intervention despite a measurable ocial communication impairment, concerns that echo prior discussions of social communication impairment (Norbury, 2014). The verbal fluency of these children may lead parents and professionals to assume that development is on track, resulting in low detection of social communication impairment. Given the literature on risks associated with social communication impairment throughout the life span, the importance of identifying such impairment during the early school years cannot be overstated. While our sample focused on middle childhood, the PRS-SA items are relevant for verbally fluent children as young as 4 years of age, since by that age children initiate and maintain topics, repair communication breakdowns, adjust messages for context, and so forth (Bauminger-Zviely & Shefer, 2021; Rollins, 1999). The PRS-SA permits a trained clinician to expeditiously detect signs of social communication impairment in an ecologically valid semistructured dyadic communicative interaction.

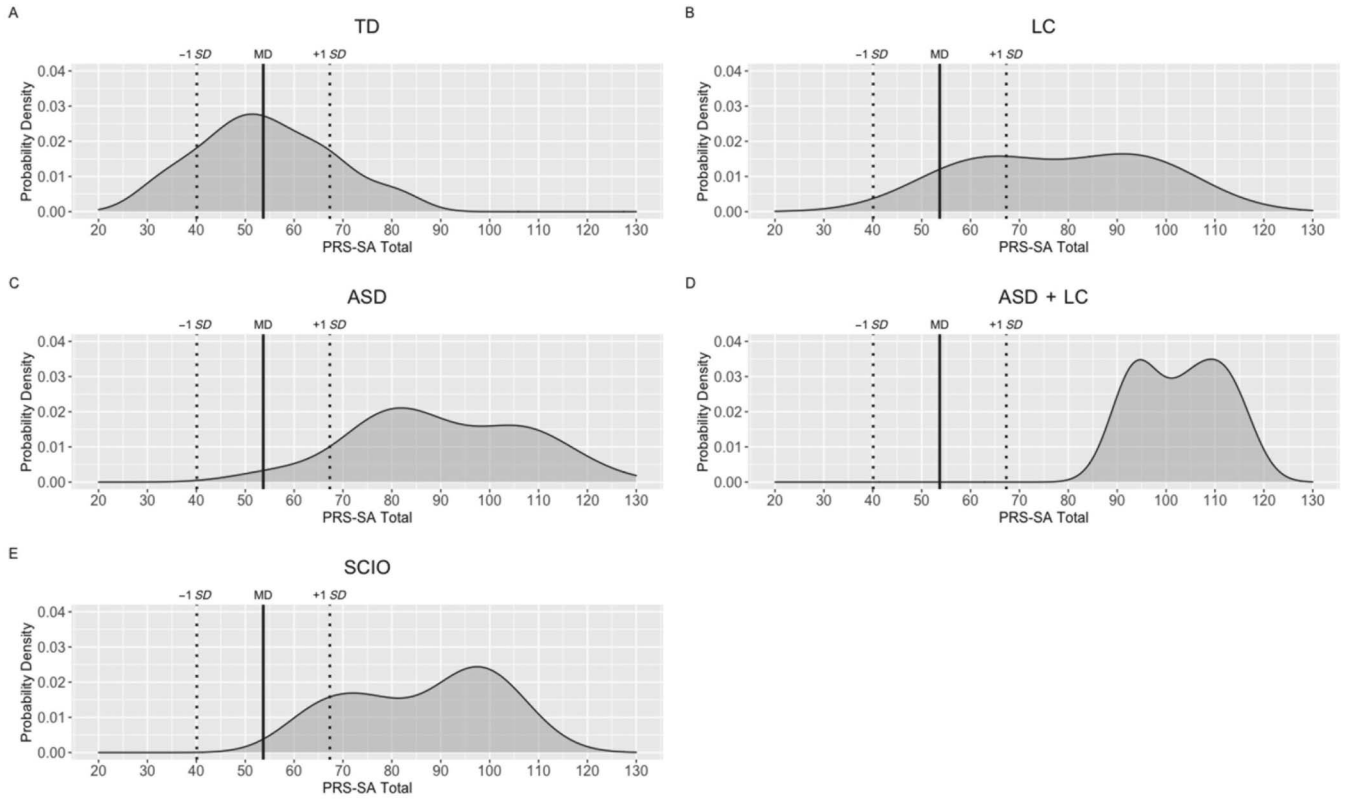
There were few (n = 5) children in this study having LC without meeting criteria for ASD. Two children with LC scored more than 1 *SD* above the TD group's PRS-SA mean, suggesting these children also had pragmatic difficulties. This is not surprising given the important role of linguistic ability (e.g., vocabulary, syntax, and figurative language skills) in producing finely tuned, topically contingent utterances (Davies et al., 2016); gleaning the gist of others' discourse; producing sufficiently informative utterances (Johnston et al., 1997); and using linguistic linking devices to generate coherent discourse (e.g., Norbury, 2005). The percentage of children with LC scoring at least one standardization above the TD mean on the PRS-SA highlights the need for children to be assessed for social communication impairment when even subtle social communication differences are noted by parents or teachers, especially when other language needs are present (Davies et al., 2016; Timler, 2018).

Clinical Implications

Results of this study indicate that the PRS-SA has promise for further investigation as an observational clinical tool for assessing social communication and detecting social communication impairment without requiring granular conversational or linguistic analysis. The moderate, significant correlation with other measures of social communication, including a parent-rated (SRS) and an examiner-rated measure of (ADOS) of social communication functioning, supports the concurrent validity of the PRS-SA. Additionally, that the PRS-SA is not redundant with these other measures supports its contribution to the field. Indeed, the ADOS-2 Module 3 has few items that assess pragmatic aspects of social communication behavior (Yuan & Dollaghan, 2018). When ASD is suspected, the PRS-SA is not a substitute for a diagnostic assessment, which often involves the administration of the ADOS-2.

The PRS-SA has added value to the field of speech-language pathology and developmental disabilities. This examiner-rated observational measure specifically focuses on social (pragmatic) communication, is aligned with *DSM-5* SCD criteria, and avoids the limitations of informant report (having limitations related to reliability and accuracy) and formal direct social communication measures (having

Figure 1. Density functions of Pragmatic Rating Scale–School Age (PRS-SA) scores across clinical groups using kernel density estimation. Mean ± 1 *SD* of the TD group PRS-SA score (age and sex adjusted) are plotted on each graph. TD = typically developing; LC = language concern; ASD + LC = autism spectrum disorder with language concern; ASD = autism spectrum disorder (only); SCIO = social communication impairment only.



no to limited discourse management assessment). Routine use of the PRS-SA as part of speech-language assessments could permit detection of social communication impairment and enable access to intervention during the wait for further diagnostic workup. Through the observational process (Adams & Bishop, 1989), the PRS-SA could be used to document type and degree of variation from the norm in social communication behaviors to guide selection of social communication intervention targets. This is of value since nonspecific social interventions are inadequate to effectively promote children's social growth (Yoder et al., 2013).

The PRS-SA is intended for use by clinically certified speech-language pathologists and licensed psychologists. Training for the PRS-SA involves three components: (a) a didactic component where the items and rating scale are explicated using video exemplars, (b) explanation of key strategies for conducting a semistructured interaction to elicit a communication sample for rating the PRS-SA, and (c) practice rating video-recorded examiner–child/youth communication samples using the PRS-SA to support interrater reliability attainment. When conducting semistructured communication interactions, clinicians should establish a standardized set of topics (e.g., vacations, favorite activities, family traditions, mishaps, and adventures) and conversation-starting materials focused on a range of themes (e.g., animals, sports, and outer space) to examine topic initiation and shifting skills, and conversational reciprocity. Preplanned strategies/probes are useful for sampling all aspects of social communication behavior related to SCD criteria in the *DSM-5*, such as use of cliff-hangers ("I let my dog out one day and he disappeared."), requesting clarification, making a few statements that require inferencing and humor, and so forth. More information use of the PRS-SA may be obtained by contacting the corresponding author.

Limitations

While this study shows promise of the utility of the PRS-SA for detecting social communication impairment in middle childhood, social communication behavior changes with development and is affected by language level. Therefore, more research is needed with a wider age span, from diverse geographic regions and races, and larger samples of children with diverse social and communication functioning. Further research is also needed to assess the stability of social communication traits in children of various ages. Such research likely will yield different cutoffs for

social communication impairment for different age groups (Anagnostou et al., 2015). Relatedly, research on the PRS-SA 7-point scale is needed to assess sensitivity to intervention response. Enrollment in the current study was dependent on language level (e.g., meeting criteria for the ADOS Module 3), rather than intellectual functioning. The literature provides evidence that language level, rather than intelligence scores, are related to social communication skills (Constantino et al., 2003; De Marchena & Eigsti, 2016). Future research will permit insights into the relation between cognitive functioning and social communication functioning as assessed by the PRS-SA. In addition, future work in a larger sample is needed to assess the factor structure of the PRS-SA; while PRS-SA items are designed to measure social communication traits, subconstructs may exist. While we present these findings as an important step toward evaluating the clinical utility of the PRS-SA, we acknowledge there are limitations to its clinical use in its current form. For example, ratings are currently validated from video-recorded ADOS samples, which are not always possible to obtain in school settings. Further work on the PRS-SA for clinical use may address optimal methods of training to promote interrater reliability.

Conclusions

Social communication skills have considerable impact on children's well-being across the life span. Currently, there are limited observational examiner-rated tools for assessing social communication impairment in a reliable and ecologically valid manner. Not surprisingly, children with and without language impairments may be missed for social communication impairments altogether (Davies et al., 2016; Timler, 2018). The PRS-SA, an examiner-rated observational measure of social (pragmatic) communication functioning, provides a total score that correctly identified most cases of social communication impairment in a middle childhood sample with diverse language and social abilities. Use of the PRS-SA when concerns about communication ability are first identified in school-age children could expedite access to intervention during the often long wait for diagnostic specialty assessments (e.g., ASD evaluations). With more research, the viability and utility of the PRS-SA as a clinical tool will be elucidated.

Author Contributions

Emily Dillon: Conceptualization (Equal), Investigation (Equal), Methodology (Equal), Project Administration (Equal), Validation (Lead), Visualization (Equal), Writing – original draft (Lead), Writing – review and editing (Supporting). **Calliope Holingue:** Data curation (Equal), Formal analysis (Equal), Writing – review & editing (Supporting), Visualization (Equal). **Dana Herman:** Investigation (Supporting), Validation (Supporting), Project administration (Supporting), Writing – review & editing (Supporting). **Rebecca J. Landa:** Conceptualization (Equal), Methodology (Equal), Project administration (Equal), Validation (Supporting), Visualization (Supporting), Writing – original draft (Supporting), Writing – review and editing (Lead).

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