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Assessing Communication in Minimally Verbal Children with Autism Spectrum Disorder

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Abstract

Purpose of review: Minimally verbal children with Autism Spectrum Disorder (ASD) may often require timely and tailored intervention to optimize their short- and long-term communication outcomes. Effective intervention relies on appropriate and accurate assessment. The purpose of this review is to summarize current and emerging issues and practices in the assessment of these children and to consider implications for research and clinical practice.

Recent findings: There is growing awareness of the need for improved assessment practices, and emerging consensus regarding principles that should underpin the assessment process. Enhanced use of existing assessment tools, as well as emerging tools, has the potential to improve practice. However, there remains a general lack of specific, sensitive, and clinically useful tools for this population.

Summary: Although the importance of appropriate assessment for minimally verbal children with ASD is well established, there remains a critical need for concerted effort to enhance approaches currently available.

Introduction

Communication impairment is central to a diagnosis of Autism Spectrum Disorder (ASD) and a key focus of interventions aimed at improving children's skills, adaptive functioning, and participation across the full range of life activities. Indeed, early communication development is both a central prognostic indicator for longer term outcomes [1] as well as one of the most readily enhanced adaptive behaviours through intervention [e.g., 2, 3]. Yet, despite the development of a range of evidence-based focused and comprehensive interventions supporting communication development, as many as one in three children with ASD start school with limited spoken language [4]. Identifying, understanding, and ultimately addressing the communication needs of children with ASD who are minimally verbal requires appropriate and accurate assessment of their communication skills and of the factors that are influencing their communication development [5].

An important first step towards understanding and addressing communication difficulties - including through improved assessment - is to clearly define the population in question. A number of terms have been used to refer to children with little or no functional speech, including *pre-verbal*, *non-verbal*, *minimally verbal*, *pre-linguistic*, and *non-linguistic* which account for, in various combinations, an individual's chronological age, communication skills, and likelihood of learning spoken language [6, 7]. For the purpose of this narrative review, we focus on assessment of children between 2 and 6 years of age. The term minimally verbal is defined as such children who have "...a very small repertoire of spoken words or fixed phrases that are used communicatively" [8]. This definition includes children who are not using functional speech. In typical development, this period from 2 to 6 years is characterized by children's rapid acquisition and use of spontaneous, creative, and flexible verbal and non-verbal communication modes for a variety of purposes across a range

of contexts [9]. Accordingly, in framing this review and the recommendations that follow, we have focused on practices that are in keeping with this broad conceptualization of communication, including those that acknowledge non-verbal, idiosyncratic, and augmentative and alternative communication modes children may be using.

Fortunately, there is growing awareness of the unmet needs of children, adolescents, and adults with ASD who are minimally verbal, and there have been a number of relevant publications in the past decade to guide research and practice. This non-exhaustive list includes the defining of spoken language benchmarks and guidance for selecting appropriate assessment tools [10] and guidance on assessing minimally verbal preschool and school-aged children with ASD [e.g., 8, 11, 12]. Here, we synthesize issues and previous recommendations, infusing them with insights from additional original studies and our own clinical and research experience, to provide a summary of current issues and common recommendations.

Principles of Appropriate Assessment

Previous authors have outlined guiding principles of appropriate assessment, including collecting information across a range of contexts, targeted selection of informal and formal assessment tools, and collecting information across a variety of developmental domains [e.g., 5, 8, 13-15]. Fundamental to appropriate assessment for all children is clearly specifying the purpose of the assessment, which may include screening, diagnosis, goal setting, monitoring and modifying interventions, and documenting outcomes, with each having different practical implications. In each case, a multifaceted approach is likely to be required, given the complex set of communication skills (e.g., verbal and non-verbal communication modes, for comprehension and expression, across a variety of functions) as well as environmental factors (e.g., communication opportunities, partner skills, availability of AAC) under consideration. Speech-Language Pathologists have the requisite skills to

interrogate and consider all factors, even if not all are directly assessed (e.g., they may not complete a phonological assessment on a child who is minimally verbal, but nevertheless informally document the child's phonological inventory). However, a comprehensive assessment requires, and benefits from, strategic multidisciplinary input, particularly in relation to differential diagnosis and accounting for comorbid conditions (e.g., intellectual disability). Multidisciplinary, and multiple stakeholder input is also important for intervention planning, whereby children who are minimally verbal will need communication support across multiple contexts and communication partners.

This process of assessment necessarily involves close collaboration with parents, caregivers, educators, and other health professionals to determine why the assessment needs to occur, what information is to be gathered and how best to collect it, who will be involved and what roles will they play, and how the findings will be communicated and used in practical ways. Central to all decisions is the welfare and interests of the child in question, including scrutiny of the relative benefits and burdens of all aspects of the assessment proposed. Despite the fact that working in the best interests of the child is implicit across guidelines to date, we suggest that explicit statements should be included in future.

Furthermore, planning for any assessment should include discussion about the practical steps that will be taken to make assessments as natural and enjoyable as possible, to monitor for signs of distress, and to ensure that approaches are selected that allow children to demonstrate their own interests, personalities, and strengths. Such an approach requires the targeted selection of tools, including standardised and non-standardised tools as well as emerging technologies.

Standardized Assessment

Standardized assessments have an important role to play in understanding communication development in children with ASD who are minimally verbal.

Standardization refers to administration of the tools in a consistent manner, allowing consistent collection of information, with a subset of these including normative data that enable children's skills to be compared to a broader community sample; in addition the tools should have established reliability and validity [5, 16]. Because of these benefits, standardized measures have featured prominently in research involving children with ASD, including those who are minimally verbal, in cases where there is a need to establish or confirm diagnosis, characterise children's skills, examine cross-sectional relationships between child and environmental factors, and evaluate outcomes [9, 17]. To illustrate, the consistent, semi-structured play-based interactions featured in the original and revised Autism Diagnostic Observation Schedule [18, 19] have not only contributed to reliable participant diagnosis and characterisation, but can also provide a consistent sampling context (semi-structured play based interaction) for comparing children's communication across clients in clinical settings and participants in research studies. Furthermore, standardized, norm-referenced assessments of prelinguistic skills, for example the Communication and Symbolic Behavior Scales [20], have the potential to shed light on early communicative behaviors (e.g., use of gesture, rate of communicative acts, imitation) that are established predictors of later communication gains in children with ASD [5].

Yet despite the benefits, standardized assessments have documented limitations including the influence of test taking experience and skills on performance and the common need to adapt administration procedures due to behavioural challenges [8, 5]. General measures of receptive and expressive language development spanning broad developmental periods [e.g., Mullen Scales of Early Learning; 21] can have floor effects for children who are minimally verbal when using standard scores. Furthermore, as children get older the options become more limited, with Kasari et al. [8] completing a comprehensive review and identifying very few valid and reliable standardised tools for school-aged minimally verbal

children with ASD; a situation much unchanged six years later. However, there have been advances in other areas, including novel item level analysis of standardised tests (e.g., whether a child uses 2-word phrases) to yield clinically meaningful data not reflected in standard scores alone [4, 22]. Furthermore, there have been ongoing attempts to optimize existing gold standard individualized assessment (e.g., naturalistic language sampling) and to develop new technological approaches for assessing communication in minimally verbal children [23].

Individualized assessment

Individualized assessment of communication is crucial for understanding how children, particularly those who are minimally verbal, may be communicating. Children with ASD present with a spectrum of individual strengths and needs, requiring multidisciplinary input for diagnosis, and assessment for goal setting and intervention [24]. Individualized assessment is particularly valuable in understanding communication in context, including children's broader repertoire of skills, needs, and interests [5]; along with opportunities for interaction, access to effective communication support including AAC, and the communication partners' knowledge and skills.

Brady and Keen [25] outlined three primary strategies for the individualised assessment of communication: informant report, direct observation, and structured observation. *Informant report*, which often take the form of parent interviews, are an efficient and effective way of gathering information about a child's skills as observed by a familiar communication partner [25]. Parents can provide information that is both sensitive and specific regarding children's developmental strengths and delays [26], and is considered a crucial element of information gathering [27]. Further, informant reports can form an important first step in collaborative practice, whereby the expertise of the parent is recognized and acknowledged while supporting parents to increase their awareness of

communication acts [25]. Parents and caregivers may observe a range of behaviours in different environments or at various times of day to those seen by clinicians, and this may contribute to different understanding of children's skills.

Direct observation involves identifying and then recording information about behaviours of interest in naturalistic situations and can provide invaluable information about how and why children communicate, particularly when the communication forms may be subtle or unconventional [25]. Indeed, naturalistic language sampling is considered the gold standard in comprehensive communication assessment for all children, including those with ASD [28, 8, 9]. Recordings of children's spontaneous language across a range of environments and with different people can be analysed and coded for a range of structural and pragmatic features [14]. This technique can provide rich information about a child's skills across domains, along with their functional use of speech, and is more sensitive to change. Analysis may include counting of behaviours of interest or transcription of spoken language using Systematic Analysis of Language Transcripts (SALT) analysis [29] or similar approaches [10]. Nevertheless, direct observation including language sample collection, transcription, and analysis can be time consuming, and may not provide enough opportunities to examine skills and behaviours of interest in the timeframe available.

Structured observation, in which the environment is engineered to create specific opportunities for communicative behaviors to occur, can help to address this issue, by eliciting a range of communicative behaviours in a more predictable way. A common approach involves the use of communicative temptations and can be particularly helpful in evoking information about known predictors of communication development — such as joint attention, symbol use, rates of communication, and communicative functions — in a consistent manner. Structured observations can also include the functional assessment of

challenging behaviors in order to replace these behaviours with safe and effective alternatives [30].

Yet in considering the different strategies outlined here, including standardized assessments, it is important to note that they are not necessarily mutually exclusive. The ADOS [18, 19], for example, when used with children could be described as a standardized assessment (based on standardized administration) with both direct observation (naturalistic sampling of social-communication interaction and behavior) and structured observation elements (a series of presses to create opportunities to observe specific skills and behaviors). Furthermore, as new technologies emerge, and as clinicians and researchers work to develop more accessible and sensitive approaches to communication assessment for children who are minimally verbal, the distinctions between approaches are likely to become increasingly blurred.

Technology in the Assessment of Children with ASD at the Prelinguistic Stage of Communication Development

The potential for technology to assist in assessing children with ASD who are minimally verbal has long been identified. For instance, Tager-Flusberg, Kasari [7] identified eye-tracking, neurophysiological measures (event-related potentials, electroencephalography), and magnetoencephalography as having potential utility over 5 years ago, but noted that challenges to their use in clinical and research settings including (a) the need for children to be trained and tolerate the testing environment and (b) the development of reliable and valid measures utilising these tools. While eye-tracking now commonly features in dedicated AAC systems to support access (i.e., operating the system via eye gaze), there has not been widespread uptake of these technologies for assessment in clinical practice. Presumably, as technology becomes more wearable and infused in consumer level equipment (e.g., physical activity sensors in watches), new avenues for developing

clinically relevant applications of these technologies may follow. Tager-Flusberg et al. [11] outlined practices developed and applied in their neurophysiological, eye-tracking, and behavioral research to enhance participants' experience and research quality, based primarily on principles and techniques derived from applied behavior analytic research (e.g., task analysis, chaining, shaping, modeling, and reinforcement).

The most pertinent technological innovation has been the development of automated approaches to language sample analysis, which seeks to learn from the communication children are already producing in interactions with other children and adults. Parish-Morris et al. [31], for example, reported on an initiative to establish an international repository of annotated language samples for children with ASD, based on ADOS recordings, including algorithms capable of detecting speech and language characteristics that differentiate children with ASD from children with typical development or related disorders (e.g., intellectual disability). In both research and practice, the Language Environment Analysis (LENA) system [32] has been identified as having potential to provide insights into communication development in children with ASD who are minimally verbal, albeit with mixed findings. While a number of authors have identified the potential for LENA to act as a sensitive measure of vocal change in children with ASD, including those who are minimally verbal, there is growing evidence of challenges with reliability and validity, particularly in children with echolalia and in older children approaching (and certainly beyond) the designated age range of 0 to 5 years [33-35].

While the number and nature of technology products that may inform communication assessment for children with ASD who are minimally verbal is growing, so is the importance of critically considering the strengths and limitations of each approach in interpreting findings especially if considering their application in clinical contexts. Furthermore, there is already evidence that even with the advent of new technologies, individualized approaches to

assessment will remain critical. Plesa Skwerer et al. [23], for example, compared four methods for assessing receptive language skills in children and adolescents with ASD who were minimally verbal. These four approaches were: (a) standardized direct assessment, (b) caregiver questionnaires, (c) eye-tracking tasks, and (d) a touch-screen task. The authors reported substantial heterogeneity across participants and measures, and thus recommended that assessment decisions be tailored to individual needs and multiple methods be employed in clinical and research settings.

Interpreting and Implementing Findings

Irrespective of the approach to assessment, integration of data into a hypothesis, beyond a basic description of the profile of behaviours children do and do not present with, is vital. This hypothesis includes why the child is presenting as they are and mechanisms to achieve maximum change. Consideration to sources and methods of information collection is important. Each stakeholder provides key information about distinct circumstances [36]. How this information was collected, including modifications to testing/environment as is a common and appropriate practice for this population [e.g., 37] must be considered. For example, providing different or additional prompts, may substantially alter the task, making the use of normative data inappropriate. Further, appropriate normative data may not exist, with most measures developed and normed with typically-developing children [see review, 36], and may be especially exacerbated in the case of adaptation for responses using AAC [8]. Interpretation should carefully consider sources of information, adaptations to testing, and normative data use.

Consideration should be given to the level of analysis, given that total scores can reflect very different individual profiles. Analysis of raw scores may yield valuable insight into communication form and function [8, 4]. For example, understanding the number of words used, or whether a child initiates and/or responds to joint attention bids, and under

what circumstances. Contextual information (e.g., familiar vs. unfamiliar examiner; prompted vs. unprompted skills) aids in our interpretation of whether the observed absence of a skill reflects performance potential or that a skill is lacking [8], thus informing not only potential goals, but also whether intervention focusses on acquisition or generalization. Consideration of what the constellation of skills taken together means is also important. For example, what does the presence of a range of gestures (for communicative) purposes mean in the absence of spoken language? We could simply interpret gestures as a strength to build on or hypothesize (and test) that the child's attempts to communicate in non-verbal mode may indicate the underlying contribution of motor speech difficulty.

Careful consideration of assessment findings is also critical to appropriate and meaningful goal setting. Parents and clinicians define important change (i.e. magnitude, priorities) differently [36]. Selection of goals should be driven by an understanding of the best available evidence (e.g., predictors, evidence-based practices), clinician expertise (e.g., operationally-defining goals, training in practices), and understanding of the child and family values and preferences (e.g., socially-valued goals) in order to appropriately interpret and implement findings driving intervention selection. Research to date points to the importance of setting goals that will lead to greater learning and participation across a range of meaningful life activities. Within a bio-psycho-social model of disability, this includes goals targeting the development of individual skills while at the same time enhancing opportunities, accessibility, and supports in the environment [38].

In terms of monitoring children's development and/or response to interventions, some caution with existing tools and further evaluation of emerging tools is required. For instance, ASD-specific tools developed to inform diagnosis have been used in research to monitor changes over time, despite a lack of validation for this purpose [36]. Further, most measures lack ASD normative data [for an exception see the Psychoeducational Profile-3, 39].

However, new measures, along with evolving approaches to interpreting existing measures, have the potential to address these issues. For instance, Grzadzinski et al. [40] published preliminary data indicating that their new measure - the Brief Observation of Social Communication Change (BOSCC) - may be a sensitive measure of social-communication change. Regarding existing measures, item level analysis of raw scores may be useful to track changes such as the number of words understood or used [8, 4]. In addition, aggregating data across sources of information may enable broad tracking, using tools such as the Developmental Disabilities Children's Global Assessment Scale [41]. Further, given the diversity of communication needs, an idiographic assessment, such as goal attainment scaling shows validity for this purpose [42], and may provide the most sensitive measure of intervention progress. Thus, a hypothesis-testing approach is valuable from assessment selection and interpretation, through to intervention and evaluation.

Proposed Future Directions

As we progress with expanding research on younger children with ASD who are minimally verbal we can begin by working toward achieving greater consistency in the ways in which children are assessed across different research studies, and eventually in clinical practice with a greater emphasis on direct assessment methods (rather than relying exclusively on parent report). There is general agreement across a range of studies that there are several important precursors for language development [e.g., joint attention, imitation, play, gestural communication; 43], but currently there are no common methods used for assessing these skills in children with ASD. A few structured protocols have been developed — such as the Early Social Communication Scales [44] to assess joint attention skills and the Rogers Imitation Battery to assess oral and manual/object motor imitation skills [45] — but there is still no gold standard practice in the field for incorporating assessment of prelinguistic skills. Furthermore, the reliance on standardized structured protocols with

preselected materials means that some children will find it difficult to engage and may thus be non-compliant.

New inroads are being made in implementing more naturalistic ecologically-valid approaches to collecting and measuring communication in children with ASD. Natural language samples have long been recommended for assessing expressive language skills [cf. 10] and the recent introduction of ELSA [Eliciting Language Samples for Analysis; 46] and ELSA-T (toddler version in development) provides the field with a standardized protocol that could be widely used for the collection of such samples. The inclusion of engaging play-based activities that could be tailored to the individual interests of a child makes this approach especially useful for assessing communication, both linguistic and gestural, in children with ASD. Protocols such as ELSA could also be adapted in future work to incorporate in a more naturalistic and child-friendly way opportunities to respond or initiate joint attention, imitation of actions or activities by an examiner, and even the evaluation of play skills.

We currently lack useful tools for directly assessing receptive language skills because standardized tests often yield floor effects with children with ASD who are minimally verbal. One direction that future research might take would be to adapt the naturalistic approaches that are used in expressive language assessment to the assessment of receptive language. For example, using an array of carefully selected age appropriate toys, the examiner could interact with the child on a joint activity and issue requests or questions that would test the child's understanding of lexical terms (e.g., nouns, verbs, adjectives), phrases (perhaps contrasting different prepositions), or even simple sentences (e.g., testing grammatical word order). The child's responses, including the time taken to comply with the examiner's statement, might yield very useful information about receptive abilities. As with ELSA, a

semi-structured but naturalistic play context that includes favoured toys and a carefully designed examiner script would need to be developed and tested for its utility.

Another direction for future work is the expanded use of technology both for the collection of children's communicative behaviour as well as for its analysis. As wearables become more popular, inobtrusive microphones and video cameras might be used to support the collection of continuous vocal and non-vocal communication measures that can provide a unique window into the everyday lives of children with ASD who are minimally verbal. Technological advances in computer vision and speech recognition algorithms will be needed to provide automated analyses of the behaviours collected in this way. For all these examples, it will be important to keep in mind the need to evaluate the psychometric properties of these innovative approaches to assessment including both reliability and validity as well as establishing some basic norms not only from typical children, but especially from the full range of the ASD population.

Conclusion

There is growing awareness, and an increasing evidence-base, to guide appropriate communication assessment for children with ASD who are minimally verbal. Advancing practice requires adherence to best practice principles, enhanced use of existing tools, and the development and validation of new tools including technology. At the heart of the issue is the need to accurately capture, understand, learn from, value, and work with the unique strengths of each individual child, to promote and support her or his right to communicate, learn, and participate in all aspects of life. Further research into valid and reliable assessment will provide vital information to understand these strengths and inform targeted, and consequently more efficacious, interventions to achieve this important goal.

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