Clinician Proposed Predictors of Spoken Language Outcomes for Minimally Verbal Children with Autism Spectrum Disorder

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# Clinician Proposed Predictors of Spoken Language Outcomes for Minimally Verbal Children with Autism Spectrum Disorder

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**Abstract**

Our aim was to explore insights from clinical practice that may inform efforts to understand and account for factors that predict spoken language outcomes for children with ASD who use minimal verbal language. We used a qualitative design involving three focus groups with 14 speech pathologists to explore their views and experiences. Using the Framework Method of analysis, we identified 9 themes accounting for 183 different participant references to potential factors. Participants highlighted the relevance of clusters of fine-grained social, communication, and learning behaviours, including novel insights into prelinguistic vocal behaviours. The participants suggested the potential value of dynamic assessment in predicting spoken language outcomes. The findings can inform efforts to developing clinically relevant methods for predicting children's communication outcomes.

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# Abstract

Our aim was to explore insights from clinical practice that may inform efforts to understand and account for factors that predict spoken language outcomes for children with ASD who use minimal verbal language. We used a qualitative design involving three focus groups with 14 speech pathologists to explore their views and experiences. Using the Framework Method of analysis, we identified 9 themes accounting for 183 different participant references to potential factors. Participants highlighted the relevance of clusters of fine-grained social, communication, and learning behaviours, including novel insights into prelinguistic vocal behaviours. The participants suggested the potential value of dynamic assessment in predicting spoken language outcomes. The findings can inform efforts to developing clinically relevant methods for predicting children's communication outcomes.

Expressive language disorder is commonly observed in children with Autism Spectrum Disorder (ASD), with up to 30% of children remaining minimally verbal when they enter school (Norrelgen et al., 2015; citation withheld for blind review). With significant short- and long-term adverse implications for education, community participation, and quality of life (Australian Bureau of Statistics, 2014; Howlin, Moss, Savage, & Rutter, 2013), early intervention often focuses on supporting spoken language development and communication more broadly. In fact, both receptive and expressive language have been documented to be malleable to evidence-based interventions (Warren et al., 2011). However, across studies, substantial individual differences are observed, with at least some children making few if any gains relative to baseline scores on receptive and expressive language measures (citation withheld for blind review). Such variability points to the need for better understanding of factors that influence intervention outcomes, including for spoken language, in children with ASD.

Vivanti et al. (2014) voiced concern amongst researchers and clinicians about a lack of knowledge about what works for which children and under which conditions. They argued for the need to move beyond broad non-specific predictors of outcome, such as cognition and language, to more sensitive predictors of change linked to specific interventions or programs, while other studies have suggested detailed evaluation of children's baseline profile to help match the appropriate interventions. There is evidence that children with lower scores on standardised assessments of cognition and language, and a greater number and intensity of ASD diagnostic characteristics in the preschool years - as a group - are at greater risk of long-term difficulties (Charman et al., 2005). However, floor effects on standardised assessments are common for children with the most complex needs, and even within groups of children who are described as minimally verbal heterogeneity in receptive language, cognition, and prelinguistic skills is common (Norrelgen et al., 2015; Plesa Skwerer, Jordan, Brukilacchio,

& Tager-Flusberg, 2016). As a result, these broad measures are unlikely to be useful in differentiating outcomes, as children with similar low scores at the time of first assessment sometimes achieve remarkable differences in spoken language outcomes (Brignell, May, Morgan, & Williams, 2018; Wodka, Mathy, & Kalb, 2013).

An alternative approach to understanding variability in outcomes is the investigation of underlying mechanisms for learning through focusing on fine grained behaviours relevant to language development (Crais, Watson, & Baranek, 2009; Kasari, Paparella, Freeman, & Jahromi, 2008). There is evidence, for example, that children who enter early intervention with better joint attention and imitation abilities, higher levels of observable social affect, fast-mapping skills, and propensity to engage in object play, show the largest gains in language development (Bopp & Mirenda, 2011; Bopp, Mirenda, & Zumbo, 2009; Mundy, Sigman, & Kasari, 1990; Poon, Watson, Baranek, & Poe, 2012; Smith, Mirenda, & Zaidman-Zait, 2007; Vivanti et al., 2014; Weismer & Kover, 2015; Yoder & Stone, 2006), and that targeting these behaviours during early intervention supports the emergence of language (Goods, Ishijima, Chang, & Kasari, 2013; Kasari et al., 2005). With many potential factors identified, distilling these to a small and clinically-meaningful set is becoming an increasing priority.

Speech pathologists who work with children with ASD are ideally positioned to inform the identification of factors that may predict communication outcomes and to consider the the practical challenges of applying findings from research to real-world clinical decision making including the prioritisation and development of assessment tools (Benvenuto, Battan, Benassi, Gialloreti, & Curatolo, 2016). To this end, (citation withheld for blind review)surveyed 187 speech language pathologists regarding factors they felt predict, mediate, and moderate outcomes for children with ASD receiving augmentative and alternative communication (AAC) interventions, identifying approximately 20 factors not yet

empirically evaluated in research, providing new avenues for exploration. However, little is known about the factors that clinicians consider when predicting spoken language outcomes for preschool aged children who present to intervention services with minimal verbal language.

The aim in the current study, therefore, was to explore speech pathologists' views regarding factors they believe predict spoken language outcomes for preschool aged children with ASD presenting to early intervention settings, and who have minimal verbal language. In contrast to (citation withheld for blind review), the study used focus groups rather than an online survey to provide a detailed exploration of participants' views and experiences and extended the focus to consider all children with ASD who are minimally verbal, not just those who have access to AAC systems. The specific aims were to explore (a) which of the many factors identified in the research literature clinicians feel are most relevant when working in clinical practice (b) potentially novel factors clinicians identify as having predictive value on the basis of their own clinical experience.

## Method

### Design

We used a qualitative design involving focus groups and the framework method of analysis (Gale, Heath, Cameron, Rashid, & Redwood, 2013) to examine clinicians' views on factors that predict communication outcomes for minimally verbal children with autism.

### Participants

Fourteen speech pathologists (13 female) were recruited for this study as part of a larger longitudinal project examining communication outcomes for children with ASD entering early intervention programs with minimal verbal language in Australia. Six participants were staff employed in 7 early intervention centres across six states and territories in Australia that were part of the larger project. These centres provide specialised

early learning programs and specific support to children with autism within a long day-care setting and employ early childhood educators along with speech pathologists and other allied health clinicians. A further eight participants were recruited through private practice networks. Purposive sampling was used in this way to recruit participants who were ideally positioned to provide insights relevant to the study aims, including a mix of professional backgrounds, years of professional experience, and workplace contexts. All participants worked with minimally verbal children with ASD within their regular caseloads and were aware that they were being invited to participate in the study on the basis that they would share insights from their experience working with this population. Participant demographics are presented in Table 1.

< Insert Table 1 about here >

**Procedure**

The second author distributed information about the study to the Centre Manager at each of the seven centres involved in the larger project, who then forwarded the information to staff. Concurrently, she also forwarded the information to speech pathologists through the team's professional networks, ensuring participation of clinicians across a range of workplace contexts as outlined above. Participants provided informed consent and were organised to attend one of three focus groups, according to availability. Focus group 1 included 7 participants, drawn from the 7 study sites, and was facilitated by the 1st and 2nd author. Focus groups 2 and 3 comprised 4 and 3 participants respectively from the wider professional community and were facilitated by the 2nd author. On each occasion, a semi-structured question guide (available on request) was used to facilitate discussion, commencing with a summary of the aims of the study and proposing the following question: "In your experience, for children on the autism spectrum, entering early intervention with little or no functional speech, what factors do you believe predict which children will go on to develop spoken

language?" Participants were invited to share their thoughts and the facilitators supported the process by providing summaries of ideas mentioned during the sessions, in order to clarify information and encourage further discussion. Notes were made in real time and the meetings recorded within a video conferencing system, allowing for later transcription. Two participants who are also authors here did not participate in any aspects of analysis pertaining to this component of the study.

**Analysis**

The framework method, as outlined by Gale et al. (2013), is a systematic form of qualitative analysis, suitable for multidisciplinary teams with differing perspectives, and yielding structured outputs. This method was chosen because of its capacity to identify patterns, differences, and relationships in data and thus draw descriptive or explanatory conclusions. This method is ideally suited for studies for which there are pre-defined concepts (in this case predictors of spoken language outcomes) to be explored, while also "…leaving space to discover other unexpected aspects of the participants' experience or the way they assign meaning to a phenomena" (Gale et al., 2013, p. 3). This combination of deductive (in this case exploring factors previously identified in literature) as well as inductive (the opportunity for participants to propose novel factors) inference, meant it was well suited to addressing the aims of the current study (Gale et al., 2013).

Analysis proceeded through seven stages as per the method outlined by Gale et al. (2013), tailored to account for the nature of data collected. In Stage 1, the second author (speech pathologist) manually transcribed the audio recordings verbatim using Microsoft Word, setting up the transcripts (word documents) with text in the middle of the page, and a column on each side for later coding (on the left) and recording of thoughts and impressions (on the right). In Stage 2, the first author (speech pathologist) and last author (psychologist) read through the transcripts to familiarise themselves with the data. During the first pass, they

read the transcripts in full uninterrupted, while during the second pass they also wrote down thoughts and impressions about the text as they read it. In Stage 3, the same two authors independently read the transcripts line by line, applying codes to ideas that they felt were important to the research aims. Coding was done manually on documents at this stage. A set of pre-defined codes was not provided at this stage, to allow for new and unexpected insights to emerge. In Stage 4, the two authors held a one-day meeting to share and discuss their coding decisions and to develop an analytical framework. The framework, as presented in Table 2, contained agreed codes and their relationship to one another, as indicated by organisation into categories and themes. The framework reflects the authors' interpretation of the data and attempts to group concepts into categories and themes in the way they were described and talked about by participants, rather than to present a definitive conceptualisation of the relationship between the different factors proposed. For instance, the theme 'cognition' included skills relating to attention, language processing, play, and behaviour regulation which could be argued to relate to different theoretical constructs, but in the context of the transcripts accounted for the way participants appeared to group these concepts. Note here also a distinction between the framework method in which the analytical framework is developed based on previous stages, and then applied to generate a data matrix which is then used to index transcripts, and other common approaches to thematic analysis (e.g., thematic analysis alone; Braun & Clarke, 2006; grounded theory which includes thematic analysis; Glaser & Strauss, 1967) in which categories and themes emerge across all phases and the schema of categories and themes presented at the final product. In Stage 5, the analytic framework and transcripts were imported into NVivo 12 (QSR International, 2018) and the first author indexed the transcripts using the agreed framework. In Stage 6, the first author generated a framework matrix containing all relevant quotes, with the categories and themes listed in columns, and participant ID number in rows. In each case, key ideas from

each participant were distilled, and illustrative quotes recorded. Finally, in Stage 7, the matrix was used as the basis for synthesising findings including identification of contrasting viewpoints, which form the basis of the results presented below. The synthesis included accounting for the fact that two themes (motivation and communication initiation) were found to be closely related and hence reported as a single theme below.

<Insert Table 2 about here>

## Results

Analysis yielded a total of 183 individual references across 9 themes. Consistent with the framework method, the descriptive data are presented in this way to provide a concise summary of trends within the data. The following is a summary of each theme, using participant quotes to convey their unique clinical insights. < Insert Figure 1 about here >

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**Cognition**

Participants discussed a range of factors that were categorised under the broad theme of cognition, including children's existing skills and their capacity to learn new skills when taught. As Janet noted:

When I look at young children, cognitive skills play a huge part, huge part.

Abigail commented on the importance of children understanding cause-effect relationships:

I think that if they've got very little contingent response… that's also not a good

indicator of developing speech.

She also noted that children have difficulties "regulating" themselves - an apparent reference to executive functioning (e.g., attention) – negatively impacts language development:

…if you're having difficulty…. helping a child to regulate, then that's not a great sign

in terms of prognosis…. there's not much you can do in terms of them actually

processing language…

Several participants commented on the relevance of play skills, including Beth who focused on the relevance of pretend play, noting:

> …If they can get somewhat better at pretend [play]… more language comes.

Nevertheless, Beth also cautioned against over-interpreting play skills in children who had been exposed to intervention:

> I do sometimes see kids who it sometimes feels a bit scripted and repetitive.

Alison expressed a similar sentiment, commenting on the importance of generalisation as a predictor of outcomes:

> I find a lot of my children when I'm teaching them a new skill for example, if I'm just teaching them vocab, if they can generalise it to a play situation their progress is a lot faster I find…. If they're not able to generalise it to the play scenario, I know that it's going to be very hard for this child to make the progress that we want to see.

While the discussions predominantly focused on the skills children had acquired, several participants instead focused on children's response to intervention provided, as evidence of their capacity to learn and for prognosis. Victoria, for example, explained:

> If there is just that responsiveness, I think really comes into whether we are going to see any interest in developing communication, verbal communication skills.

Meanwhile, Katie suggested that not only children's trajectories, but also the presence of positive surprising shifts, may be particularly relevant to outcomes:

> I find it a curious question to ask parents what has your child done that surprised you recently. And often that will lead you to something that you might not have thought of.

**Motivation and Initiation**

Participants identified the presence of observable attempts to communicate, even in the absence of an effective mode, as an important predictor of spoken language outcomes, as Leanne explained:

…those kids who might not be using any spoken words but you can tell that they are trying to make verbal approximations, or they're just generally vocalising…. at least they're [understanding] that their voice has an impact on the environment around them….You can get that gut feeling of 'oh I feel this kid might have a lot more in there than what he's presenting.

In contrast, they expressed concern for children they perceived to be passive, noting the impact on desire to communicate; as Janet and Alison explained:

Those children who are really passive, they're the kids that down the track are still going to have really limited interests…. Not always, but very often they're the kids that are very slow... [Janet]

…for some children just developing a bank of motivators is a goal in the early stages because if they're not interested in anything I struggle to make any progress, particularly with the requesting side of things. [Alison]

Donna agreed:

Yeah I agree and I feel that social motivation and drive to communicate is often the hardest to break through. If a child has motivation but it is motor speech or language [difficulty], we can [help them] communicate in another way.

Consistent with these observations, several participants went on to explain how children's response to the provision of an effective communication mode can provide insights into their prognosis. Sally, for example, commented:

I think that arguably the children who, where the social connection is better, when you introduce them to an aided system, sometimes they jump on that. It's kind of like,

hang on I've been desperately trying to communicate with people and now you've got

this aided system and I'm like, 'yes I can communicate now!'.

Other participants commented on the importance of insistence and persistence in

communicative attempts as a strong predictor of likely response to intervention, as Leanne

explained:

You can tell whether a child's really motivated to work with you through [their]

persistence and insistence… they want to show you in lots of different ways, I feel

like they're the kids that you can kind of make more of a prediction around yeah,

they've got some more spoken language…

**Engagement**

Participants frequently spoke about children engaging with other people and the world

around them, suggesting higher levels of engagement is a strong predictor of communication

outcomes. Charlie and Leanne noted:

Definitely how engaged they are and how involved they are socially with their joint

attention. You can kind of pick some kids who are going to progress a bit more than

others. [Charlie]

…that reciprocity and joint attention, from the very beginning of seeing the child [are

important], it's much easier to get going and [you] get that feeling that you'll get a

good impact from therapy. [Leanne]

Meanwhile, Janet reflected on the potential relevance of facial expression as an indicator of

social engagement, noting concern for children who convey a limited range of emotions

through their expressions:

Some of those kids are really limited in their facial expressions… those kids I think

probably tend to be kids who don't progress as fast maybe.

**Restricted, repetitive, and sensory behaviours**

In the context of discussing motivation and engagement, participants frequently commented on a perceived inverse relationship between communication and restricted, repetitive, ritualistic, and sensory behaviours, citing these as barriers to engagement and subsequent learning. For example, Alison suggested that self-stimulatory behaviour constituted the greatest barrier to engagement, and hence response to intervention:

> I used to think that non-compliance was the biggest barrier and the hardest thing but now I think it's more the impact of their self-stimulatory behaviour. Because if the child's in a world that is so reinforcing, it's impossible for me to get them out of that world. And that's what I find is one of the most challenging barriers because I'm trying to compete with this world that they're so consumed in and it just makes my job impossible.

Beth agreed, honing in on a particular type of behaviour she saw as being critical to outcomes:

> Those kids who are using their body as the stims, they're the ones that are incredibly difficult to break out of because they've got such a limited range. They can just use themselves to stim on… so if I'm looking trying to develop some of that communication, then that's a really difficult thing for me to do. And they're the kids that I know are going to be challenging to work with.

Janet commented on the impact of self-stimulatory behaviour on children's play and use of prelinguistic skills as precursors to spoken communication, suggesting a cluster of skills can be impacted:

> [Being able to] reproduce that play initially [and] show some degree of imitation skill is really important in [considering] whether kids are going to go [on] and be able to actually easily learn language. And I think that's what you see at that early stage, which you don't see with those kids who are doing a lot of that stim.

**Prelinguistic skills**

In considering the skills that children display, relevant to engagement and communication outcomes, participants frequently spoke about prelinguistic behaviours. Among these, joint attention, use of gestures, and imitation were the most prominent. Shannon, for example, reflected on the importance of joint attention to predicting communication outcomes:

With joint attention, absolutely it's so important. I find that the children can often initiate, even my low-functioning kids, but their response to joint attention is poor. Those who are more responsive I find are more likely to develop better language skills.

Abigail spoke about the importance of gesture, again suggesting that its relationship to other skills is important:

I think that delayed gesture is another, in terms of very delayed pointing, not happening at 3, is an indicator and I also think that limited interests – that ties with the motivation, that's another key indicator.

Notably, in talking about gesture, Abigail suggested that comprehension and use of gesture at an early age, in the context of songs and rhymes, may provide an early insight into likely communication outcomes:

One thing I've noticed is [that] attention to song is very common [even] when no other attention is occurring, particularly with song and finger rhymes. [The fact] that they do attend to the song and like those very very early finger rhymes, that's a very positive indication…

**Imitation**

Imitation, although a form of prelinguistic skill and thus relevant to the theme above, was discussed with sufficient frequency to warrant coding as a specific theme. In particular,

participants spoke about the importance of the purpose and quality of imitation in predicting spoken language outcomes. Victoria, for example, spoke about the importance of joint attention resulting in imitation:

[regarding joint attention], we like to see that develop first. But then also tying into that their imitation skills I think are a great predictor of whether we'll see language emerging.

Charlie proposed a link between imitation of motor actions and speech, noting:

…those kids often go on to have difficulty with imitating speech sounds if they've got difficulty with imitating motor actions in play.

Shannon focused on the social quality of the imitation, suggesting a playful quality is associated with more positive communication outcomes:

The kids who have imitation in a playful kind of way… those kids are [in] a completely different ball game as opposed to the kids who can imitate but don't really see the need or the fun in it… [The children who imitate in a non-playful manner] might develop language, and it might be functional, but I think it's less likely to be the language that takes off [to become] reciprocal use of language.

**Vocalisations**

There was detailed discussion surrounding children's vocalisations as a predictor of communication outcomes across all focus groups. There was consensus that children's production of any vocalisations, even if atypical with respect to phonemic repertoire, intonation, or directness is a positive predictor for outcomes, providing a platform on which to develop skills. To illustrate, in commenting on echolalia, Leanne noted:

I know it's not functional but there's already some spoken language there and you can kind of go 'well there's something I can work with here' to develop that development of functional language later.

Several participants spoke about children presenting with a limited range of vowels, suggesting these children are likely to have poorer outcomes. Suzanne, for example, noted:

> I'm sure everyone's worked with kids who are just making lots of vowel sounds, so they are unable to shape any consonants and vary the sounds that they're producing to start approximating words.

However, Charlie and Janet went beyond repertoire, to discuss the way in which children use the sounds they have, suggesting such behaviours are relevant to predicting spoken language outcomes:

> …they seem to get really stuck on repetitive, unusual vowel sounds…. Instead of using it as an attempt to communicate, they just rather do it for their own reasons and that seems to be those kids, they stick with vowel sounds and they never seem to develop anything else." [Charlie]

> One of the other things that I think is really telling, and there's not research around this at all, but it's the quality of the vocalisations that the kids use and the type of babble that the kids use. And there are kids that come in and they make this sound… ticka ticka ticka ticka. And people will say, oh they're babbling and he's got lots of speech sounds that he uses and he goes ticka ticka ticka ticka. And those kids are nowhere near any form of speech, language, [or] being able to imitate. And it's not a typical babble that they would have heard environmentally. [Janet]

Katie, reflecting on Janet's comments, proposed that these patterns of vocalisations seen in the preschool years may carry through to adulthood, and suggested that greater attention needs to be paid to identifying what is unique about children's speech patterns, rather than focusing just on the extent to which they may not display those seen in typical development:

> When I think about the adults I work with who are minimally verbal, many of those adults have non-traditional sounds in the vocalisations that they make. They're using

guttural sounds, they're using tongue clicks, they're using vowels that we wouldn't

necessarily hear. And when you speak to the parents of those young adults, they will

say that they've always had that pattern.

**Communication Response**

Children's response to the communication of others, including comprehension of

language, was specifically mentioned by several participants. Leanne commented on

children's ability to understand and infer in their environment as an important predictor of

communication outcomes:

> …those kids who come in those first few weeks who are already following an
>
> instruction or you can tell that they're getting some sense of the routine quite quickly.
>
> You can get a feel for those guys [that] they are actually picking up some of the
>
> verbal language that's going on around them.

However, Sally suggested that although relevant, factors underpinning interactions, which

provide the context for comprehension and learning may in fact be more relevant in this

cohort of children:

> But on the comprehension note, I think we certainly see the children whose receptive
>
> language is better at intake certainly on average would do better. [However] I still
>
> think that … social connectedness seems to be anecdotally a bit more important than
>
> receptive language, in my opinion.

**Comorbidities**

The final theme identified during analysis related to what participants perceived to be

comorbidities (as distinct from being intrinsic to ASD), suggesting these combine to create

barriers to communication development. Shannon, for example, noted the relevance of

comorbidities in children with more complex learning needs:

If I have those [children] who have lower cognitive functions, so our [children with] moderate or severe [difficulties], what makes a difference is their comorbidities, and when I think about that I think particularly about attention and anxiety, that's a huge impact.

She went on to describe how physical health can impact language and engagement:

…those kids who are particularly unwell and need to be hospitalised, or missing opportunities to interact with other people, that affects their ability to develop language too.

Lyn suggested:

"From a health view, [questions about] are they sleeping, are they fed, are they well [are all relevant]"

Finally, returning to considerations regarding vocalisations, several participants suggested that co-morbid motor speech disorders, including childhood apraxia of speech (CAS), may be indicated for some children, and where this occurs it is a negative predictor for positive communication outcomes:

So we've got a couple of kids… who have come in and are just really quiet… and some of them do have, we think, reasonable social connection, so my money is on the fact that they're probably having some pretty significant motor speech issues. [Suzanne]

But just from what I've seen, sometimes I do think is it a combination of ASD and CAS. And when I see that I feel like I can say well this child won't talk for a very long time. [Alison]

**Discussion**

The aim in the current study was to examine speech pathologists' views regarding factors they believe predict spoken language outcomes for preschool aged children with minimal verbal language. The findings highlight  the wealth of knowledge and insight that clinicians have in relation to the issue, but at the same time, the complexity of predicting outcomes as evidenced by considerable overlap across themes and references to clusters of factors being relevant (e.g., motivation, joint attention, imitation, self-stimulatory behaviours in various combination). Here, we consider the insights provided, their relationship to previous research, and implications for future research and clinical practice.

Our first aim was to explore which of the many factors identified in the research literature clinicians feel are most relevant when working in clinical practice. To this end and as evidenced by the themes and categories, the speech pathologists identified a range of factors including cognition, prelinguistic communication skills, and comorbidities for which there is a strong evidence base in relation to children with ASD (Bopp & Mirenda, 2011; Bopp et al., 2009; ciation withheld for blind review; Mundy et al., 1990; Poon et al., 2012; Smith et al., 2007; Vivanti et al., 2014; Weismer & Kover, 2015; Yoder & Stone, 2006), and increasingly regarding children who are also minimally verbal (citation withheld for blind review). Notably, in relation to cognition, participants almost uniformly spoke about clinically-relevant constituent skills such as understanding cause-effect relationships and children's responses in situations in which people attempt to teach them new skills, rather than the broader concept of intellectual ability, consistent with calls for a focus on fine-grained predictors of outcomes in research (citation withheld for blind review). Therefore, while the findings provide evidence for the social validity of broad factors previously identified in research (e.g., cognition, prelinguistic skills, comorbidities), they also indicate the importance of framing and investigating factors in such a way that they align with readily observable, clinically-relevant behaviours that clinicians see, can evaluate, and can support,

in the children with whom they work. Such an approach requires (a) closer clinician-researcher collaboration to distil relevant factors, (b) the development of clinically relevant and feasible tools to measure them, and (c) the consistent embedding of such tools in clinical and community intervention studies, consistent with calls for greater collaboration amongst clinicians and researchers as the foundation for evidence-based practice (Harold, 2019).

Our second aim was to identify potentially novel factors that speech pathologists believe may predict spoken language outcomes for young children with ASD who are minimally verbal, with participants sharing several novel insights. First, there is a growing body of evidence regarding the potential relevance of early speech perception and characteristics in children with ASD. These include proposed differences in processing auditory information (Kuhl et al, 2005; Cui et al., 2017) including differentiating auditory stimuli and perception of prosody (Charpentier et al., 2018), lexical tones (Wang et al, 2017), and differences in syllables (Kuhl et al., 2005), as well as in phonological development, babbling, intonation, prosody, stress, and pitch when compared to typically developing children, and children with other developmental delays (Bonneh, Levanon, Dean-Pardo, Lossos, & Adini, 2011). Participants in the current study emphasised the relevance of the 'quality' of vocalisations, with Janet and Katie focusing particularly on repetitive patterns of speech that children were unlikely to have heard or had modelled for them by child or adult communication partners (e.g., 'ticka-ticka-ticka'). The participant insights from this study suggest that further research combining bodies of knowledge, possibly in this case to include both early auditory processing and verbal production, may be fruitful and could be joined with technological advances in automated language analysis  (Rankine et al., 2017; Warlaumont, Richards, Gilkerson, Messinger, & Oller, 2016; Warren et al., 2010) to develop clinically relevant and feasible methods for assessment and monitoring of outcomes.

The participants' comments could also be seen to encourage further research into the possible relationship between ASD and motor speech difficulties, including childhood apraxia of speech (CAS). This is an area of study with only emerging evidence, but if found to be relevant could provide new intervention pathways for children who are minimally verbal, building on the relatively small body of research into motor-speech interventions (e.g., Rogers et al., 2006; Wan et al., 2011). Autism Spectrum Disorder has been reported as part of the phenotype of some genetic aetiologies of CAS (e.g., Morgan & Webster, 2018) and emerging evidence from electrophysiological studies suggests children with ASD and children with CAS may present with similar over-specification of speech sounds (Froud & Khamis-Dakwar, 2012)(Sokhadze, El-Baz, Farag, Sokhadze, & Tasman, 2016) and that differences in early childhood may be associated with later development of expressive vocabulary (Riva et al., 2018). It needs to be acknowledged that the research findings on type and prevalence of speech difficulties in children with ASD are equivocal (Shriberg, Paul, Black, & van Santen, 2011; Shriberg, Strand, Jakielski, & Mabie, 2019), with sampling and methodological differences likely contributing to variability across studies. Our findings suggest that clinicians would value research aimed at informing assessment for differential diagnosis and intervention. Nevertheless, the speech pathologists' frequent references to clusters of factors rather than single predictors highlights the need to not overly simplify the often complex communication needs experienced by children with ASD.

(citation withheld for blind review), in their survey of speech pathologists working with children with ASD with minimal verbal language who use AAC, identified a range of factors that were also identified here, including prelinguistic skills, motivation, communication initiation, and comorbidities, further validating their potential relevance. However, whereas participants in the [author names withheld) study identified the relevance of additional factors relating to communication partners (e.g., knowledge and skills) and

intervention characteristics (e.g., AAC system design), the participants in the current study focused on children's responses to learning opportunities. This included looking at children's compensatory strategies (e.g., use of gestures and other non-verbal communication), their trajectories (e.g., first 6 months) when provided interventions, and specific comments regarding their response to augmentative and alternative communication (AAC) modes when provided.  The potential value of dynamic assessment has been long recognised in relation to children with ASD (e.g., Nigam, 2001). The findings of this study support renewed endeavour to develop new tools, with speech pathologists, other allied health practitioners, and educators being ideally positioned to suggest creative and clinically feasible ways to design and implement these. Katie (participant) suggested there may be value in looking at "surprises for parents" as predictors of outcomes, which could be operationalised as positive unexpected changes in children's development. The notion that positive unexpected patterns of development, as opposed to incremental progress, may foreshadow positive spoken language outcomes in minimally verbal children is intriguing and may be readily explored through secondary data analysis and accounted for in the design of future studies. Unexpected episodes demonstrating progress have the potential to shed light on how, and under what conditions, children are most likely to learn.

In considering the findings, we note several limitations. First, the study includes only a small subset of the wider clinical community, and a broader inter-disciplinary sample would likely yield additional insights and support efforts to prioritise examination of the most promising factors. In addition to such studies, we encourage authors when reporting intervention trials to include brief summaries of unique qualitative insights from participants, caregivers, research team members, and other relevant stakeholders regarding factors that may have impacted outcomes, in addition to systematic interrogation of hypothesised factors identified apriori. A second limitation may relate to the fact the majority of the clinicians

were working in early intervention centres or other organisations in which research was embedded. Accordingly, it is likely that the participants had greater knowledge of relevant research literature and may have had a tendency to draw on their knowledge of research rather than clinical insights alone, when considering potential predictors in comparison to the broader population of clinicians. While a positive outcome of this may have been more straightforward alignment between observations and previous literature in many cases, a potential drawback may be a missed opportunity to learn more from clinicians with less exposure to research about what they see as being particularly salient in everyday clinical practice.

A third limitation is that analysis focused on once-off focus groups for each participant, rather than the triangulation of multiple data sources. For instance, future studies of this nature could include follow-up semi-structured interviews with individual participants to explore ideas further and presentation of case scenarios to provide a consistent frame of reference for participants in considering potential factors. Furthermore, future studies could engage with clinicians prospectively as they work with children in order to examine the potential relevance of factors they deem important to individual children, and include guided client case reviews to provoke further reflection and elaboration, possibly yielding additional insights.

**Conclusion**

The findings provide evidence to support the clinical relevance of a range of factors (e.g., prelinguistic communication skills, cognition, motivation and communicative initiations) identified in research to date when it comes to predicting communication outcomes for children with ASD who are minimally verbal. Furthermore, the findings provide possible pathways for further identification of factors and the development of tools to measure these in clinical and research settings. This includes insights that support further

exploration of prelinguistic vocal behaviours and a renewed focused on dynamic assessment as a way of understanding children's response to learning situations. Finally, the participants' insights demonstrate the critical role that clinicians – in this case speech pathologists – can play in research to better understand and ultimately address factors relevant to clinical outcomes for children with ASD, and provide support for a collaborative approach to advancing research and practice in this area.

**Compliance with ethical standards**

The study received ethical clearances from the Human Ethics Committees at [institution details withheld for blind review]. The authors have no conflict of interest to declare.

<div align="center">References</div>

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Table 1. Participant Characteristics

| Pseudonym | Current role[1] | Years of experience | Workplace |
| --- | --- | --- | --- |
| Charlie | Speech pathologist | 2 | Specialist childcare |
| Sam | Speech pathologist | 3 | Specialist childcare |
| Victoria | Speech pathologist | 4 | Specialist childcare |
| Alison | Speech pathologist | 6 | Private practice |
| Donna | Speech pathologist | 8 | Specialist childcare |
| Leanne | Manager | 10 | Non-government organisation |
| Beth | Speech pathologist | 15 | Public health system |
| Suzanne | Manager | 16 | Specialist childcare |
| Sally | Manager | 17 | Specialist childcare |
| Janet | Speech pathologist | 30 | Private practice |
| Abigail | Speech pathologist | 30 | Private practice |
| Lyn | Speech pathologist | 30 | Private practice |
| Katie | Clinical educator | 30 | University |
| Shannon | Speech pathologist | 35 | Private/public health system |

[1] Note all participants were trained as speech pathologists.

Table 2: Analytical Framework of themes and categories[1]

| Themes and categories | |
|---|---|

**Cognition**
Attention to music-rhyme
Cause-effect
Choice making
Generalisability
Object permanence
Play level
Rate of learning
Referential-Associate Learning
Regulation-arousal

**Motivation**
Communicative Intent
Independence
Interests-motivations
Passivity
Persistence
Play repertoire

**Communication Initiation**
Communicative functions
Follow lead
Leading others
Sharing
Showing
Social interaction
Range
Requesting
Compensatory Strategies

**Engagement**
Awareness
Body orientation
Facial expression-range
Reciprocity
Shared delight
Social avoidance
Social connectedness

**RRB and Sensory**
Self-stimulatory behaviours
Sensory behaviours

**Prelinguistic**
Eye contact
Joint Attention
Pointing
Repertoire
Gestures

**Imitation**
Behaviour
Imitation
Object
Social-Playful
Vocal

**Vocalisations**
Echolalia
Intonation
Phonetic inventory
Quality
Repertoire
Volume

**Communication Response**
Comprehension
Response to social interaction
Response to name

**Comorbidity**
Anxiety
General health
Hearing-Vision
Nutrition
Sleep
Motor speech disorder

[1] This table presents the analytical framework developed at stage 4 of analysis, with theme and category labels reflecting the authors' interpretation of the focus of participants'

comments. This framework was then used to index all transcripts and produce a framework matrix, reported in the results.