

Critical Review:
Can imitation, joint attention and the level of play in preschool years predict later language outcomes for children with autism spectrum disorder?

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This critical review examines the potential for three pivotal language skills, imitation, joint attention, and level of play to predict expressive and receptive language outcomes in school-age children with autism spectrum disorder (ASD). Each study employed a longitudinal, prospective design. The weight of the evidence reviewed provides compelling evidence that imitation, joint attention and toy play can be predictive of later language outcomes in children with ASD. Recommendations for future research and clinical implications are discussed.

Introduction

Children with autism demonstrate significant deficits in both expressive and receptive language, specifically in joint attention, imitation, and play (Paul et al., 2008). Pivotal skills are abilities that act as a foundation for learning a new higher-level skill. Pivotal skills in language development include imitation (Ingersoll & Schreibman, 2006), symbolic play (Koegel et al., 1999), and joint attention (Charman, 2003). Imitation is the repetition of body movement, vocalization, or facial expression that provides a means of communication (Rogers et al. 2003). Children with ASD typically have impaired imitation of actions on objects, manual and postural movements, and oral-facial movements. Joint attention involves coordinated and mutual attention between two people toward an object or event through eye gaze, pointing, or showing (Bono et al., 2004) and appears in the average child around 6-12 months of age (Charman, 2003). Initiating joint attention and responding to joint attention are two groups of joint attention behaviors (Bono et al., 2004); responding to joint attention is considered a higher-level skill. Children with ASD typically demonstrate impaired joint attention (Charman 2003). Play is a hierarchical skill comprised of social interaction and communication. Three important types of play are relational (combining objects in a manner that is not functional or symbolic), functional (using an object for its intended use), and symbolic (treating an object as if it is something else). In children with ASD play is often limited, lacking diversity, and characterized by repetitive manipulations (Dominquez, 2006).

According to Eaves & Ho (2004), it is not the amount of intervention that predicts later outcome in ASD, but the child's early language skills. This suggests it is efficacious to identify the specific language skills that are predictive of later outcome to help guide intervention programs to meet the diverse needs of the population (Kovshoff et al., 2011). Furthermore, predictive variables may contribute to the early

diagnosis of autism, the understanding of severity and prognosis, and provide a foundation for future research (Paul et al., 2008).

Objectives

The primary objective of this review is to provide a critical evaluation of existing literature regarding the effectiveness of measuring level of play, imitation, and joint attention as an approach to predict later expressive and receptive language outcomes in preschool-aged children with ASD. The secondary objective is to propose evidence-based recommendations for future research and application in clinical practice.

Methods

Search Strategy

Computerized databases including Google Scholar, PubMed, SpringerLink and Web of Knowledge were searched using the following terms: (autism spectrum disorder) OR (autism) OR (ASD) OR (pervasive developmental disorder) OR (play) OR (imitation) OR (joint attention) AND (predictor) OR (outcomes) OR (prognosis) AND (expressive) OR (receptive) AND (language) AND (social skills) OR (pragmatics).

Selection Criteria

Studies included in this critical review were required to examine the use of imitation, joint attention, or play as predictive measures. As well, expressive or receptive language had to be an outcome of interest. In addition, a longitudinal design was required, along with a measure of change in language over time. No limits were placed on the intervention program, participant's age, race, gender, socio-economic status, family status, or caregiver characteristics. Inclusion was limited to studies conducted within 12 years, as our understanding of ASD has expanded immensely.

Data Collection

Results of the literature search yielded nine articles consistent with the selection criteria for inclusion in this review. Included studies were prospective, longitudinal designs. The intent of this review was to focus on imitation, joint attention, and play as potential predictors of later expressive and receptive language outcomes.

Results

Stone and Yoder (2001) employed a prospective, longitudinal research design to predict language development in 35 children ages 23-35 months (ASD, n=24 and pervasive developmental disorder—not otherwise specified PDD-NOS, n=11) who had no previous intervention. Each child's abilities were assessed at baseline using a comprehensive assessment battery. Monthly phone calls and annual clinic assessments were conducted over a 2-year period to track development. A correlational analysis was conducted to identify a relationship between play, imitation, and joint attention to spoken language development. Findings indicated joint attention and object play were not significant predictors of expressive language development when language ability at age 2 was controlled.

Stone and Yoder implemented a well-designed research study with well-identified participants. One limitation is the small sample size, which limited the exploration and identification of each child's abilities in the ASD population. Each child's joint attention skills were measured via parental report. The validity and reliability of this measure may be confounded, as it is unknown if each parent was able to accurately identify and track all of their child's initiations and responses to joint attention. Therefore, these skills were not appropriately measured. Furthermore, assessment measures changed from baseline to follow-up, thus affecting the ability to directly compare data. Overall, findings provide suggestive evidence that joint attention and play are not predictive of expressive language development.

Charman, Baron-Cohen, Swettenham, Gillian, Drew and Cox (2003) employed a longitudinal, prospective research design to examine predictive associations between joint attention and level of play to language outcomes in 18 children ages 20 months (ASD, n=9 and PDD-NOS, n=9). Children were prospectively identified as having ASD from the Checklist for Autism in Toddlers (CHAT) and diagnosis was confirmed at a later date. Each child's abilities were assessed using a battery of assessment measures over a 2-year period. In addition, informal measures were used to assess early language abilities. A non-parametric analysis was used because scores were not normally distributed. The

Mann-Whitney U-test was used to compare outcomes of expressive and receptive language abilities in children with ASD compared to PDD-NOS. Findings indicated a higher response to joint attention and motor imitation skills at 20 months was related to receptive language in children with both high and low autism severity ratings. The results provide no significant evidence to support functional play with objects as a predictor of language outcome.

Charman et al. provide a comprehensive analysis of characteristics in children with ASD and PDD-NOS. Results are limited by the small sample size and young age of the participants. The young age and variability may have lead to floor effects, thus skewing the data. In addition, the measures obtained may not be reliable, due to the inherent difficulty of assessing young children. Each child's level of play was assessed during a 5-minute observation in the clinic. The limited time and context may have confounded the data collected for this assessment measure, thus confounding the results. Overall, this study provides suggestive evidence that joint attention at 20 months predicts language outcome and equivocal evidence that functional play with objects predicts language outcome.

Toth, Munson, Meltzoff and Dawson (2006) implemented a longitudinal cohort design to identify if joint attention, imitation, or toy play is predictive of current and later language ability in 60 children ages 34-52 months (ASD, n=42 and PDD-NOS, n=18). Each child's abilities were assessed using a battery of common assessment tools to obtain a baseline measure of abilities. Subsequently, the Vineland Adaptive Behaviour Scales (VABS) parent survey form was administered every 6 months to parents via telephone for an average of 6 times. Results from the follow-up telephone interview were analyzed through growth curve modeling to explore the rate of language acquisition. Findings indicated immediate verbal imitation and initiation of joint attention at baseline was associated with higher receptive and expressive language skills. Deferred imitation and toy play were significantly correlated with the development of communication skill. There was no significant evidence to support joint attention.

Toth et al. provide a well-designed longitudinal cohort design with well-identified participants and excellent application of statistical analysis. A significant limitation was there was no formal reassessment in the clinic at the final measurement date. Although the parent interview may have provided useful data, it is unlikely that the results obtained provided a comprehensive and valid profile of the child's abilities. Overall, this study provides suggestive evidence that

play, imitation, and joint attention is predictive of later language ability.

Yoder (2006) implemented a longitudinal research design to identify environmental predictors associated with expressive vocabulary development in 35 children ages 21-54 months (ASD, n=32 and PDD-NOS, n=3). Inclusion criteria required each child to have fewer than 10 spoken words. Each child's abilities were assessed using a comprehensive testing battery to identify baseline function. Each child's lexical density was subsequently measured 6 and 12 months after the initial assessment using one formal and two informal measures. Mixed-level modeling was used to identify individual growth curve parameters. The growth curves were used appropriately to predict expressive language development. Findings indicated intentional communication and diversity of object play at baseline were predictive of lexical density growth after controlling for baseline expressive language.

Yoder provides a well-designed longitudinal design with well-identified participants and an appropriate assessment of baseline and follow-up abilities. Overall, findings provide suggestive evidence, due to the relatively small sample size, that object play is predictive of expressive vocabulary growth. Imitation and joint attention were not an area of focus in this particular study.

Anderson, Lord, Risi, Shulman, Welch, DiLavore, Thurm and Pickles (2007) employed a prospective, longitudinal research design to examine the rate and pattern of growth in verbal skills in 206 children ages 2 to 9 yrs (ASD, n=98, PDD-NOS, n=58, and nonspectrum developmental delay, n=50). Each child's abilities were assessed over a 7-year period at ages 2, 3, 5, and 9 using a full battery of diagnostic and psychometric instruments. Data were analyzed using an appropriate growth curve analysis to compare the three diagnostic groups with respect to baseline presentation of skills, rate of change, and pattern of change. Findings indicated almost every participant demonstrated development in verbal language. Nonverbal age equivalent (NVAE) scores and joint attention were associated with verbal development. Lack of joint attention skills was a risk factor for the group with slowest developing rate and greatest symptom severity. Higher NVAE's and caregiver education were found to predict placement in the most rapidly progressing group with above-average verbal skills.

Anderson et al. provide a well-designed longitudinal study with well-identified participants and good sample size. One limitation was that factors such as family SES status and involvement in treatment services were not

considered. As well, a standardized assessment of expressive and receptive language may have provided a better measure of ability. Overall, this study provides compelling evidence a relationship exists between early joint attention and later expressive language in children with ADS and PPD.

The degree to which treatment may have influenced later outcome was not measured. Families with lower SES or lower expectations may have filtered out due to the long-term commitment, thus skewing the sample dynamics. Had a spontaneous language sample been completed, a better measure of expressive language ability may have been acquired.

Smith and Zaidman-Zait (2007) implemented a prospective, longitudinal research design to examine if pre-linguistic skills predict expressive vocabulary development in 35 children ages 20-71 months diagnosed with ASD. Inclusion criteria required each child to speak less than 60 words and receive an average of 15-20 hours per week of intervention. Each child's skills were reassessed at 6, 12, and 24 months post-treatment through parent report over the phone. Cluster analysis was used to explore the effect of higher-level skills compared to lower-level skilled groups. Children were grouped based on vocabulary development over 2 years. Data were analyzed using growth curve estimators, general linear model analyses of variance (ANOVAs) and analyses of covariance (ANCOVAs) to identify variables predicting optimal language development and compare the difference in ability in each group. The number of spoken words, presence of verbal imitation, object play, and initiating joint attention at baseline were associated with higher vocabulary growth.

Smith & Zaidman-Zait provide a well-designed longitudinal study with well-identified participants. One limitation is the small sample size that restricted mixed-level analysis, thus compromising the statistical outcome. The participant ages likely confounded data collection, as expected abilities of children ages 1 through 5 differ. In addition, assessment results of older children have been found to be more predictive of later ability than in younger children (Luyster et al., 2007; Thurm et al. 2007). Another limitation is the assessment measures changed over the study, potentially skewing data collection. Overall, the results are suggestive that imitation, play, joint attention, and vocabulary at baseline are related outcome.

Thurm, Lord, Lee and Newschaffer (2007) employed a prospective, longitudinal research design to predict language outcomes in 118 children ages 2-3 (ASD, n=59, PDD-NOS, n=24, and nonspectrum

developmental delay, $n=35$). Each child's abilities were reassessed using a common battery of assessments until 4-5 years of age at follow-up. Significant predictors of language were identified by a t-test and multiple linear regressions. Findings indicate that responses to joint attention were related to receptive language development, while imitation of simple sounds was specifically associated with expressive language outcome. Early communication skills and nonverbal cognition were identified as predictors of expressive and receptive language acquisition by age 3, but not before. This suggests predictors may vary depending on the child's chronological age at the time of assessment, which is consistent with findings in a study conducted by Luyster et al. (2007).

Thurm et al. implemented a well-designed research study with a good sample size and comprehensive evaluation of child's demographics and baseline language abilities. The degree to which assessments measured each child's ability is questioned, as floor effects were evident in some cases. Furthermore, assessment instruments changed over time, which may have confound results. Overall, the results of this study provide compelling evidence that joint attention and imitation may be used to predict receptive and expressive language abilities respectively.

Paul, Chawarska, Cicchetti and Volkmar (2008) implemented a prospective, longitudinal single-group cohort design to identify a potential profile of strengths in communication and predictors of expressive language development in 37 children ages 15-25 months diagnosed with ASD. Each child's abilities were assessed using an assessment battery over a period of 2.5 years at ages 36-58 months. Scores from three formal assessment measures were converted to z scores, which were averaged to obtain a pooled expressive communication outcome measure. This measure served as the outcome variable for a linear regression analysis. Six variables including symbolic play and response to joint attention were chosen as predictors in the regression analysis to assess the impact of these variables on the pooled expressive communication z score. Findings indicated that children with higher receptive language, production of sounds and words, use of play schemes, response to joint attention, and limited to no repetitive behaviours had the highest overall language outcomes. Upon review of the findings, it was identified that response to joint attention was most often predictive of receptive language gains and higher-level play was most often related to expressive language development.

Paul et al. provide a well-designed longitudinal study with a comprehensive evaluation of social

communication and language abilities of each participant. Results were displayed graphically to allow for a visual representation of each child's performance and relative strengths and weaknesses. One limitation is the small sample size, which may have not have encompassed the variability within ASDs. Overall, findings provide suggestive evidence that responding to joint attention, nonverbal cognition, and production of words during play are predictive of higher language outcome.

Siller and Sigman (2008) implemented a longitudinal research design to evaluate the pattern of language development in 28 children ages 31-64 months diagnosed with ASD. Each child's abilities were measured at four data collection periods to measure developmental trajectories. In addition, the relationship between initiating joint attention and subsequent language development was investigated. A multilevel model analysis was employed to evaluate change in language abilities between and within participants, as well as the mean and variability of individual growth parameters to assess longitudinal language growth. Findings indicate the child's ability to initiate joint attention at baseline was the strongest predictor of language growth.

Siller & Sigman provide a well-designed longitudinal study with well-identified participants. Each child observation had four blind observers rate each child's abilities at baseline, increasing reliability of the results. Multilevel modeling appropriately accounted for the stability of differences in language over time. One limitation is the small sample size and variable chronological ages at baseline, which restricted researchers from drawing conclusions of each child's global development. The results of this study are suggestive that responding to joint attention is a predictor of language outcome.

Discussion

The weight of the evidence suggests that imitation, joint attention, and level of play contribute to language development. Findings must be compared with caution, as children's baseline function, social history, treatment history, and ages varied. Of the nine studies, seven identified joint attention as a predictor of later language outcome, especially responding to bids for joint attention. In addition, three studies provided evidence for imitation and three for toy play, as predictors of language outcome. Research participants, data collection, and statistical design were similar in studies conducted by Thurm et al. (2007) and Anderson et al. (2007), which provided suggestive evidence that joint attention is predictive of language outcome. Although

findings from Charman et al. (2003) do not suggest joint attention and play are predictive of outcome. It was judged that the young age of participants and small sample size affected the outcome, thus results should be interpreted with caution. Although there is a smaller body of evidence to support imitation and toy play as predictive variables, the studies were judged to be well designed, thus are good indicators that these skills are predictive of later outcome.

Each study employed a longitudinal design, which is appropriate based on the research purpose. Growth curve analysis and trajectories were used appropriately in 5 of the aforementioned studies, as they included at least three or more waves of data in the analysis. Given the nature of the aforementioned studies, the time and effort involved in longitudinal studies, and the heterogeneous population, there will inadvertently be similar limitations. Seven of the nine studies had a sample size less than 50. A larger sample would have enabled further exploration and a more comprehensive evaluation of the growth trajectories in joint attention, imitation, and level of play for each child and their global development. Floor effects were evident in some studies, likely due to the wide range of ages. Some studies controlled for reliability by having multiple observers. However, it was judged to be difficult to develop and obtain reliable measures of early developing language skills. Few studies controlled for the range of ages, type of intervention, and other social interactions each child received.

Further research should explore the extent to which a single behaviour independently influences each child's outcome (Sherer 2005). Identifying predictive language abilities of later outcome leads researchers to question if these early language skills can be targeted in early intervention. Each child's characteristics are rarely examined with respect to progress in treatment (Kasari 2002). Koegel et al. (1999) provided evidence that children with ASD can learn joint attention through direct instruction. Recent research by Kasari et al. (2008) provided compelling evidence that play and joint attention can be taught to young children with ASD through direct instruction. Each child's early language abilities were measured at baseline and over a 2-year period. Findings indicated an optimal outcome for children who were directly taught each skill compared to a control group. Replicating these results will contribute to the results in this review and the guidance of individualized intervention for children with ASD.

Recommendations

Future research should focus on the following in order to provide more compelling evidence:

- Complete a comprehensive inventory of each child's demographics, family characteristics, intervention history, and social interactions at baseline in order to control for potential confounding variables
- Rate each child's severity of ASD systematically at baseline in order to identify change at follow-up
- Include a larger sample size to account for the heterogeneous population
- Administer reliable and valid assessment measures that remain consistent throughout entire study
- Obtain outcome measures into adolescence

Clinical Implications

In summary, clinician's will consider that higher-level abilities in joint attention, imitation, or toy play will effectively predict optimal language outcomes in children with ASD. It is important to consider that play and imitation are most predictive of expressive and receptive language development respectively. Impairment in one or more of these skills may be identified as young as 6 months, which may contribute to early diagnosis. Future research is needed to identify how efficiently each child may learn an early language skill and the relation to language outcome.

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