



2015

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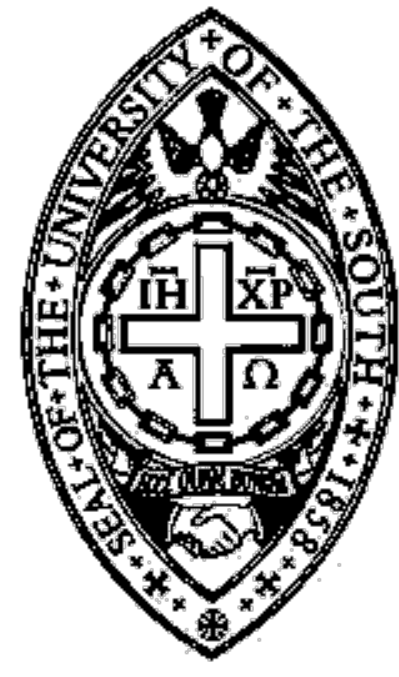
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## Recommended Citation

Smith, Alli; Lyons, Megan; Tsatsanis, Katherine; and Paul, Rhea, "Longitudinal Predictors of Functioning in Children with ASD" (2015). *Speech-Language Pathology Faculty Publications*. 127.  
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# Longitudinal Predictors of Functioning in Children with ASD

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## Background:

- Children diagnosed with autism spectrum disorders (ASD) of educated, non-minority mothers were more likely to exhibit improvements in functioning (Fountain et al., 2012).
- Stone and Yoder (2014) found that hours of speech and language therapy made independent contribution to prediction of spoken language outcome amongst children diagnosed with ASD.
- The acquisition and use of expressive language (EL) in children with ASD has been correlated with longitudinal improvements and optimal outcomes in functioning (Gillberg, 1991).
- The study of EL, particularly its proximal and distal influences, help to identify factors related to the trajectory of overall functioning for individuals diagnosed with ASD.

## Objectives:

To examine whether maternal education and number of intervention hours are correlated and/or predictive of a range of developmental outcomes in a longitudinal cohort of children diagnosed with ASD.

## Participants:

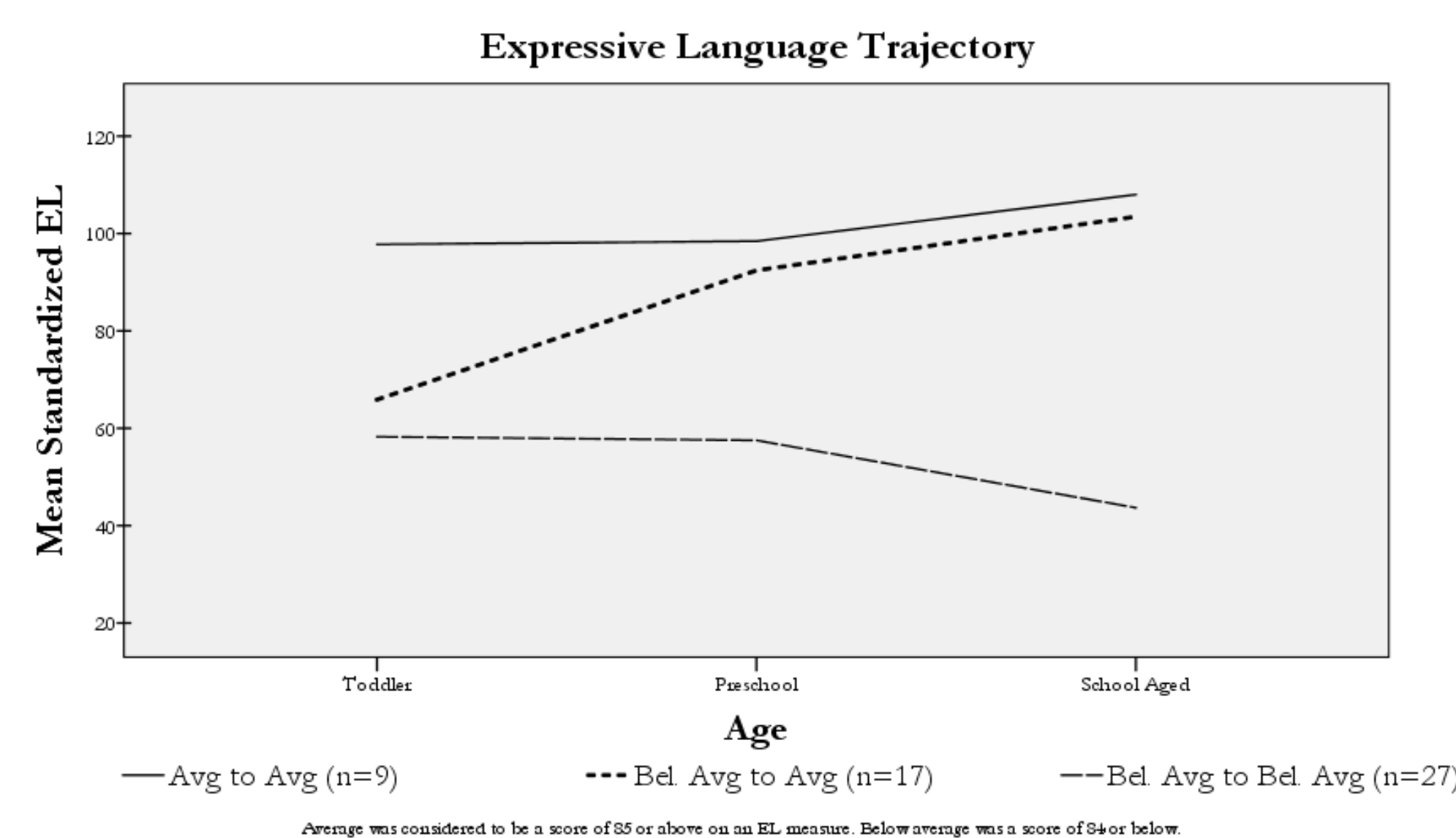
53 Participants with ASD were derived from a longitudinal cohort of children evaluated at 3 points in time as part of a federally funded project looking at the developmental processes, trajectories and predictors of outcome in a longitudinal cohort. All participants were seen at least three points: Age 2 (toddler), visit 1 (V1); Age 4 (preschool), visit 2 (V2); Age 8 (school age), visit 3 (V3).

Table 1. Participant Demographics by Visit

Visit	n	Age in Months (SD)	EL Standard Scores (SD)	Non-Verbal DQ (SD)
1	53	27.16 (5.57)	67.08 (16.85)	75.89 (13.90)
2	50	52.32 (3.68)	75.13 (22.55)	78.23 (21.41)
3	53	105.45 (7.60)	75.22 (34.07)	89.12 (26.42)

The EL trajectory for those having either avg. EL or below avg. EL across visits, and those with a positive EL trajectory (below avg. to avg.) were also examined. The group with a negative EL trajectory was excluded from these analyses (n=3).

The two groups who initially had below average EL at toddlerhood were matched for age and, non-verbal developmental quotient (NV DQ), derived from averaging the age-equivalents from the Fine Motor and Visual Reception subdomain scores of the Mullen Scales of Early learning (MSEL), divided by the child's actual age, and then multiplied by 100.



## Analyses:

*Pearson Correlation* was used to determine the strength of association between environmental factors at toddlerhood (parental education level & intervention hours) and performance on measures (child and parent report) at subsequent visits.

- Initial analyses were run with variables from the following assessments: the Vineland II (VABS II; Sparrow et al., 2007), the Mullen (MSEL; Mullen, 1995), Calibrated Severity Scores from the ADOS (CSS; Gotham et al., 2009), the Clinical Evaluation of Language Fundamentals (CELF-4; Semel et al., 2003), the Differential Abilities Scale II (DAS-2; Elliot, 1990), and the Reynell Developmental Language Scales III (RDLS-3; Edwards et al., 1997).
- Initial analyses were also run with the following environmental variables: total number of hours of intervention services, which included speech and language therapy, developmental education, occupational therapy, physical therapy, and social skills training, and the total weekly hours of Applied Behavioral Analysis (ABA). Parent education level and demographics were collected via an adapted version of the Hollingshead (Hollingshead, 1975).

*Principal Component Factor Analyses* with Varimax and Kaiser normalization were used to distill interrelated groups of toddler aged factors.

*Multiple Linear Stepwise Regressions* were used to determine which principal components were predictive of EL outcomes at preschool and school aged.

*Discriminant Function Analyses* were used to determine which principal components were predictive of trajectory cohort membership.

## Results:

*Pearson Correlation* showed significant correlations between toddler environmental factors and outcomes on measures at preschool and school age (see Table 2).

Table 2. Correlations

	Toddler RL DQ/SS	Preschool Vineland Daily Living	Preschool Vineland Comm.	Preschool EL DQ/SS	Preschool RL DQ/SS	Preschool CSS	School Age EL DQ/SS	School Age RL DQ/SS	School Age GCC
Maternal Education Level	-	.325*	.310*	.390**	.500**	-	.317*	.306*	.481**
Paternal Education Level	.360**	-	-	-	-	-	-	-	-
Toddler Interventions	-	-	-	-.349*	-.304*	.316*	-	-	-
Toddler ABA	-	-	-	-	-	.336*	-	-	-
Preschool Interventions	-	-	-	-	-	-	-	-	-
Preschool ABA	-	-	-	-	-	-	-	-	-

\*p<.05. \*\*p<.01. \*\*\*p<.001. -n.s. Due to the diversity of age ranges and child performance across visits, language DQs were calculated (for both receptive language (RL) and expressive language (EL) age-equivalent scores from several developmental measures (MSEL; RDLS) were divided by the child's chronological age and multiplied by 100 to compare against standardized scores from school-age language measures (CELF-4).

*Principal Component Factor Analyses* derived three unique principal components at toddlerhood: performance on child outcome measures (PC1), family and community resources (PC2), and ASD symptomology (PC3).

- PC1: Vineland Communication, Vineland Social, EL, and RL.
- PC2: Mother's education level, Father's Education Level, ABA, and Intervention Services.
- PC3: CSS (based on raw total scores of the ADOS).

## Results Using PC1, PC2, & PC3:

*Multiple Linear Stepwise Regressions* results show that PC1, PC2, and PC3 predicted 56% of the variance in preschool EL ( $r^2 = .560$ ,  $F(3, 40) = 16.956$ ,  $p < .001$ ). (see Table 4)

At school age, only PC1 and PC2 were predictive of EL, accounting for 47% of the variance ( $r^2 = .471$ ,  $F(2, 42) = 18.673$ ,  $p < .001$ ). (see Table 5)

*Discriminant Function Analyses* (Table 6) showed that PC1, PC2, and PC3 together were able to predict 83% of trajectory cohort membership

## Results Using PC1, PC2, & PC3 Continued:

Table 4. Hierarchical Regression for Preschool EL

Variable	B	SE B	p	ΔR <sup>2</sup>
<b>Step 1</b>				
PC1	14.12	2.85	.000	.368
<b>Step 2</b>				
PC1	14.65	2.65	.000	
PC2	-7.15	2.53	.007	.103
<b>Step 3</b>				
PC1	14.38	2.45	.000	
PC2	-7.01	2.34	.005	
PC3	6.52	2.30	.007	.088

Table 5. Hierarchical Regression for School Aged EL

Variable	B	SE B	p	ΔR <sup>2</sup>
<b>Step 1</b>				
PC1	21.61	3.89	.000	.418
<b>Step 2</b>				
PC1	21.79	3.75	.000	
PC2	-7.96	3.89	.047	.053
<b>Excluded Variable</b>				
PC3		1.48	.147	

Table 6. Classification Results of PC1, PC2, and PC3

Trajectory Cohort	Predicted Trajectory Cohort (%)			
	Bel. Avg to Avg.	Bel. Avg to Bel. Avg	Avg. Avg.	Total
Bel. Avg to Avg.	81.3	18.8	0	100
Bel. Avg to Bel. Avg	16.7	83.3	0	100
Avg. to Avg.	14.3	0	85.7	100

a.83.0% of original grouped cases correctly classified.

## Conclusions:

- Correlations show that maternal education is related to many preschool and school aged outcomes, similarly paternal education was associated with a toddler language comprehension outcome. These findings emphasize the role of caregivers in creating an enriching early language environment.
- Intervention and ABA both showed negative correlations on performance measures, suggesting that children with more severe ASD symptomology received more hours of intervention and ABA.
- Results demonstrate that early performance on child outcome measures, as well as family and community resources, predict longitudinal EL outcomes.
- ASD symptomology was only predictive of preschool EL outcomes, suggesting that toddler symptomology severity is not absolute through childhood.
- Discriminant Function Analyses showed the strength of identified factors in predicting EL trajectory cohort membership. The 17% unaccounted for by identified factors implicates the need for further study.

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## Acknowledgements

Preparation of this paper was supported by Research Grant 2P01 HD003008-38 funded by the National Institute of Child Health and Human Development (NICHD)-Developmental Processes, Trajectories, and Predictors of Outcome in a Longitudinal Cohort.

