

# Predictability of Toddler Language and Cognition Measures for Later Language

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## Introduction

A great deal of research in the past decade has focused on the reliability of early language measures to predict language development at some later point in time (Rescorla, Roberts & Dahlsgaard, 1997; Scarborough, 1990; Thal & Tobias, 1992; Whitehurst & Fischel, 1994). Most of this work has focused on “late talkers” and is based on the premise that it is important to be able to identify as early as possible children who may be at risk for later language and learning problems. Since many of these studies include case control children, this work can also add to our understanding of the normal trajectory of language and learning.

Given that there is great variability in the development of language during the early stages of language growth, primarily in the expressive language domain, many children who appear delayed in their language abilities fall within the normal range of language development by the later preschool years. In general, receptive language has been a much more consistent indicator of language abilities (Thal & Tobias, 1992).

The ability to predict the course of language acquisition is a particularly important issue for children who are born into families with a history of language-based learning impairments. There is evidence that these children are at greater risk than the normal population for developing language-based learning disabilities by virtue of the fact that they have a first degree relative with this impairment (Rice, Haney & Wexler, 1998; Spitz, Tallal, Flax & Benasich, 1997; Tallal, Ross & Curtiss, 1989; Tallal, et al, submitted, Tomblin, et al. 1989). Accurate identification of these children is of primary importance so that, if necessary, intervention can begin as early as possible.

## Hypothesis

Based on previous research in the area of preschool language development and children from families with a history of language-based learning disabilities, we would predict:

1. Measures of receptive language at 24 months will predict both receptive and expressive language skills at 48 months.
2. Of the three measures of expressive language collected at 24 months, some may be better predictors of expressive and receptive language at 48 months than others.
3. As a group, children from families with a history of language-based learning impairments, will perform more poorly on measures of receptive and expressive language at both 24 and 48 months than children from families with no history of language-based learning impairments.

## Subjects

As part of a larger longitudinal study of the relations between infant perceptual abilities and later cognitive and language-based learning outcomes, 63 children received both language and general cognitive assessments at 24 and 48 months. Of the children in the present sample, 23 were born into families that had a positive family history for language-based learning difficulties (i.e. at least one primary relative had been positively identified as having a language-based learning disability).

# Measures

The following measures were administered as part of a larger perceptual and neuropsychological battery:

## 24 Months

Preschool Language Scale-3 (PLS-3: Zimmerman, Steiner and Pond, 1992). The PLS-3 assesses receptive (auditory comprehension) and expressive (expressive communication) language skills in infants and young children from birth to 5 years, 11 months. Standard scores for receptive and expressive language are reported (mean=100, s.d.=15).

MacArthur Communicative Development Inventories (CDI: Fenson, et al, 1993). A parental report measure that provides age and gender norms for word production and sentence complexity. Percentile scores are reported.

## 48 months

Preschool Language Scale-3 (PLS-3) See above.

Clinical Evaluation of Language Fundamentals-Preschool (CELF: Wiig, Secord & Semel, 1992). The CELF assesses receptive and expressive language development in children from 3 years to 6 years, 11 months. Two subtests were administered: Sentence structure which measures comprehension of progressively more complex sentence forms (passives, embedded clauses, prepositional phrases, etc) and Word Structure which examines expressive morphology requiring the child to use plurals, irregular nouns and verbs, tense markers, prepositions and pronouns.

Stanford-Binet Intelligence Scale, Fourth Edition: (Thorndike, Hagen & Sattler, 1986). This test measures four broad areas of cognitive abilities and produces a general composite score. Two subtests of the verbal reasoning scale were included as additional language measures: Comprehension, as a receptive language measure and Vocabulary as an expressive language measure. Standard scores (Mean=50, s.d.=7) are reported.

## Results

**Table 1: Correlations of Specific Language Measures at 24 & 48 Months**

		At 24 months				
		PLS		CDI		
		receptive	expressive	word production	sentence complexity	
At 48 Months	PLS	receptive	.42**	.39**	.47**	.35**
		expressive	.40**	.34*	.46**	.47**
	PCELF	word structure	.31*	.24*	.27*	.43**
		sentence structure	.40**	.36*	.27*	.40**
	Stanford Binet	vocabulary	.45***	.42**	.40**	.34**
		comprehension	.56**	.43**	.49***	.54***

All language measures at 24 months were significantly correlated with all language measures at 48 months (\* $p < .05$ ; \*\*  $p < .01$ ; \*\*\* $p < .001$ ).

Measures of language ability at 48 months were more highly correlated with general measures of receptive language (PLS) at 24 months than with general measures of expressive language at 24 months.

Specific measures of language form at 24 months (CDI: vocabulary and sentence complexity) were more highly correlated with general measures of expressive and receptive language (PLS & Stanford Binet) at 48 months than with the specific language forms (PCELF) at 48 months.

## Results

**Table 2: Correlations Among 24 & 48 Month Language Measures by Family History**

			<i>At 24 months</i>							
			PLS				CDI			
			receptive		expressive		word production		sentence complexity	
			FH+	FH-	FH+	FH-	FH+	FH-	FH+	FH-
<i>At 48 Months</i>	PLS	receptive	.41	.36*	.46	.29	.34	.56***	.40	.34*
		expressive	.25	.47**	.33	.34	.29	.56***	.58***	.41*
	PCELF	word structure	.41	.35	.40	.29	.07	.31	.25	.48**
		sentence structure	.29	.40*	.43	.21	.00	.41*	.37	.44*
	Stanford Binet	vocabulary	.26	.46**	.28	.41*	.14	.49**	.33	.34*
		comprehension	.49*	.57**	.41	.42*	.28	.59***	.42	.60***

**FH+** = Positive Family History

**FH-** = No Family History

Overall, correlations among 24 and 48 month language measures were stronger for children with a negative family history (\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ ).

## Results

**Table 3: Mean Language Scores at 24 Months by Family History**

		FH+		FH-	
		Mean	(s.d.)	Mean	(s.d.)
PLS	<b>receptive</b>	96.6	(13.9)	105.1	(17.1)
	<b>expressive</b>	98.2	(13.3)	105.4	(13.6)
CDI (%ile)	<b>word production</b>	41.0	(28.9)	55.3	(31.7)
	<b>sentence complexity</b>	48.0	(26.2)	58.9	(25.8)

All scores were within the normal range, but scores for the positive family history children were consistently, though not significantly, lower than scores for the negative family history children ( $.05 < p < .10$ ).

## Results

**Table 4: Mean Language Scores at 48 Months by Family History**

		FH+		FH-	
		Mean	(s.d.)	Mean	(s.d.)
PLS	<b>receptive</b>	109.7	(18.9)	115.1	(17.1)
	<b>expressive</b>	110.4	(18.4)	112.9	(13.6)
PCELF	<b>word structure</b>	10.2*	(3.7)	12.3*	(3.7)
	<b>sentence structure</b>	11.4	(2.7)	12.0	(2.7)
Stanford Binet	<b>vocabulary</b>	53.3	(6.2)	56.4	(31.7)
	<b>comprehension</b>	54.8	(7.5)	56.7	(25.8)

Although mean language scores for the family history positive children were above the general population average, they were still minimally lower than the scores for the family history negative children. The preschool CELF: Sentence Structure subtest, a measure of receptive grammar, was the only measure that was significantly lower for the family history positive children (\* $p < .05$ ).

# Results

**Table 5: Children in the Impaired Range\* by Family History**

<i>At 24 Months</i>		<b>FH+</b>	<b>FH-</b>
PLS	<b>receptive</b>	35%	15%
	<b>expressive</b>	20%	9%
CDI (%ile)	<b>word production</b>	27%	14%
	<b>sentence complexity</b>	23%	11%

<i>At 48 Months</i>		<b>FH+</b>	<b>FH-</b>
PLS	<b>receptive</b>	14%	9%
	<b>expressive</b>	14%	0%
PCELF	<b>word structure</b>	10%	3%
	<b>sentence structure</b>	10%	3%
Stanford Binet	<b>vocabulary</b>	29%	11%
	<b>comprehension</b>	29%	17%

\* at least 1 standard deviation below the mean

For all language measures at 24 and 48 months a greater percentage of the children with a positive family history for language-based learning difficulties fell into the impaired range compared to children with no family history for language-based learning difficulties.

## Discussion and Conclusions

- All measures of receptive language at 24 months were significantly correlated with all measures of receptive and expressive language at 48 months supporting the notion that receptive language is a useful predictor.
- Although measures of expressive language at 24 months were significantly correlated with all language measures at 48 months, the more specific measures of expressive language form (CDI) at 24 months showed the strongest correlation with Stanford Binet language comprehension measures. This suggests that more detailed knowledge of children's expressive language at 24 months can give better information about their language performance at 48 months.
- Overall, at 24 months, children born into families with a positive family history of language-based learning impairments performed more poorly on measures of language ability than children born into families with no history of language-based learning impairments. However, by 48 months, there were only small differences in the mean language scores between children with and without a family history of language-based learning impairments except for the PCELF- sentence structure subtest which measures grammatical understanding.
- Although overall language scores for the family history positive and family history negative children converge at 48 months, there is evidence to suggest that children who are at risk for language and learning impairments often appear to “catch up” in the late preschool years only to experience difficulty in language learning during the early school years when language demands are highest (Scarborough and Dobrich, 1990).
- Language scores alone may not be enough to predict which children will experience difficulties later on. Benasich & Tallal (1998) found that infant (6 & 9 month) information processing measures were among the best predictors of later language abilities irrespective of family history.

## Discussion and Conclusions

- There was a consistent pattern over time in the percent of children who fell into the impaired range on all language measures. The percentage of children with a positive family history for language-based learning difficulties that fell within the impaired range was always greater than for the children without a family history of language-based learning difficulties.
- These children are being followed through the early school years to determine:
  1. How the earliest information processing measures and subsequent language and cognitive measures predict school-aged language and reading skills,
  2. If the children with a positive family history for language-based learning impairments continue to be at risk for later language and learning difficulties.

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## References

- Benasich, A. A., & Tallal, P. (1998). Infant processing of auditory temporal information: Links to family history and later language outcome. *Society for Neuroscience Abstracts*, 24, 819.
- Fenson, L., Dale, P. S., Reznick, J. S., Thal, D., Bates, E., Hartung, J. P., Pethick, S., & Reilly, J. S. (1993). *Technical manual for the MacArthur Communicative Development Inventory*. San Diego: Singular Press.
- Rescorla, L., Roberts, J., & Dahlsgaard, K. (1997). Late talkers at 2: Outcome at 3. *Journal of Speech, Language and Hearing Research*, 40, 556-566.
- Rice, M., Haney, K. R., & Wexler, K. (1998). Family histories of children with SLI who show extended optional infinitives. *Journal of Speech, Language and Hearing Research*, 41, 419-432.
- Scarborough, H. S. (1990). Very early language deficits in dyslexic children. *Child Development*, 61, 1728-1743.
- Scarborough, H. S. & Dobrich, W. (1990). Development of children with early language delay. *Journal of Speech and Hearing Disorders*, 33, 70-83.
- Spitz, R. V., Tallal, P., Flax, J., & Benasich, A. A. (1997). Look who's talking: A prospective study of familial transmission of language impairments. *Journal of Speech and Hearing Research*, 40, 990-1001.
- Tallal, P., Ross, R., & Curtiss, S. (1989). Familial aggregation in specific language impairment. *Journal of Speech, Language and Hearing Disorders*, 54, 167-173.
- Tallal, P., Hirsch, L. S., Realpe-Bonilla, T., Miller, S., Brzustowicz, L., & Flax, J. F. (Submitted). Familial aggregation in specific language impairment. *Journal of Speech and Hearing Research*.
- Thal, D., & Tobias, S. (1992). Communicative gestures in children with delayed onset of oral expressive vocabulary. *Journal of Speech and Hearing Research*, 35, 1281-1289.
- Thorndike, R. L., Hagen, E. P., & Sattler, J. M. (1986). *Stanford-Binet Intelligence Scale: Guide for Administering and Scoring the Fourth Edition*. Chicago: The Riverside Publishing Company.
- Tomblin, B. J. (1989). Familial concentration of developmental language impairment. *Journal of Speech and Hearing Disorders*, 54, 287-295.
- Whitehurst, G. J., & Fischel, J. E. (1994). Early developmental language delay: What, if anything, should the clinician do about it? *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 35, 613-648.
- Wiig, E. H., Secord, W., & Semel, E. (1992). *The Clinical Evaluation of Language Fundamentals-Preschool: Examiner's Manual*. The Psychological Corporation: Harcourt Brace Jovanovich, Inc.
- Zimmerman, I. L., Steiner, V. G., & Pond, R. E. (1992). *The Preschool Language Scale-3: Examiner's Manual*. The Psychological Corporation: Harcourt Brace Jovanovich, Inc.