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ABSTRACT

An assessment battery, measuring multiple aspects of language, was administered to 29 children between 4 and 5 years of age who had been born prematurely. The children, who weighed less than 2,500 grams at birth after less than 37 weeks of gestation, were recruited from a cohort of children originally admitted to the neonatal intensive care unit of the University of Alberta Hospital. All children had been examined by a pediatric neurologist at 18 months, and 20 were judged to be neurologically suspect. Each child was assessed in terms of oral/motor aspects, verbosity, phonological aspects, receptive semantics, expressive semantics, receptive syntax, and expressive syntax. Outcomes were categorized as pass/fail. Each child's passing score was the number of aspects passed out of a total of seven. The majority of neurologically normal preterm children had high passing scores, but appeared to be at risk for mild language delay. The majority of neurologically suspect preterm children had lower passing scores. They also performed significantly lower on several measures than did the neurologically normal children. Consequently, they appeared to be at risk for moderate and more generalized language delays. Language aspects most at risk for delay were oral-motor, phonological, and syntactic development. Semantic development, specifically lexical comprehension, was the least likely to be delayed. (AC)

LANGUAGE DEVELOPMENT OF PRETERM CHILDREN

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ABSTRACT

AN ASSESSMENT BATTERY, MEASURING MULTIPLE ASPECTS OF LANGUAGE, WAS ADMINISTERED TO TWENTY NINE 4-5 YEAR OLD PRETERM CHILDREN (LESS THAN 2500 G AND UNDER 37 WEEKS GESTATION). TEN CHILDREN WERE CONSIDERED NEUROLOGICALLY SUSPECT AT 18 MONTHS. A PROFILE OF PASS OR FAIL ACROSS ASPECTS YIELDED A PASSING SCORE. NEUROLOGICAL STATUS WAS CORRELATED WITH SCORE. THE MAJORITY OF NEUROLOGICALLY NORMAL PRETERM CHILDREN HAD HIGH PASSING SCORES BUT APPEARED TO BE AT RISK FOR MILD LANGUAGE DELAY. THE MAJORITY OF NEUROLOGICALLY SUSPECT PRETERM CHILDREN HAD LOWER PASSING SCORES. THEY ALSO PERFORMED SIGNIFICANTLY LOWER ON SEVERAL MEASURES THAN THE NEUROLOGICALLY NORMAL CHILDREN. CONSEQUENTLY, THEY APPEARED TO BE AT RISK FOR MODERATE AND MORE GENERALIZED LANGUAGE DELAYS. ASPECTS MOST AT RISK FOR DELAY WERE ORAL-MOTOR, PHONOLOGICAL AND SYNTACTIC DEVELOPMENT. SEMANTIC DEVELOPMENT, SPECIFICALLY LEXICAL COMPREHENSION, WAS THE LEAST LIKELY TO BE DELAYED.

PURPOSE

FOLLOW-UP RESEARCH ON THE LANGUAGE DEVELOPMENT OF PRETERM CHILDREN HAS PROVIDED EQUIVOCAL RESULTS. VARIATION IN SUBJECT AGE, OUTCOME MEASURES AND NEUROLOGICAL STATUS ARE MAJOR VARIABLES THAT MAY ACCOUNT FOR INCONSISTENCY IN FINDINGS.

CHILDREN IN THE INFANT/TODDLER STAGES ARE MOST OFTEN FOUND TO EXHIBIT LANGUAGE DELAYS. THESE DELAYS APPEAR TO DIMINISH WITH AGE.

OUTCOMES MEASURES HAVE INCLUDED VERBAL INTELLIGENCE SUBTESTS, COMPOSITE LANGUAGE TESTS OR TESTS OF A SPECIFIC ASPECT OF LANGUAGE SUCH AS VOCABULARY OR SPEECH SOUND PRODUCTION. THESE MEASURES DO NOT YIELD PROFILES OF PERFORMANCE ACROSS THE MULTIPLE ASPECTS OF LANGUAGE.

NEUROLOGICALLY SUSPECT AND ABNORMAL CHILDREN ARE AT GREATER RISK FOR LANGUAGE DEFICITS THAN NEUROLOGICALLY NORMAL CHILDREN.

IN THIS STUDY, PRETERM CHILDREN WERE STUDIED AT 4-5 YEARS OF AGE, WELL BEYOND INFANT/TODDLER STAGES. A BATTERY OF MEASURES WAS COMPLETED ON EACH CHILD WHICH YIELDED A PROFILE OF PERFORMANCE ACROSS MULTIPLE ASPECTS OF LANGUAGE. A SUBGROUP OF CHILDREN CONSIDERED NEUROLOGICALLY SUSPECT AT 18 MONTHS WERE COMPARED WITH THE LARGER GROUP OF NEUROLOGICALLY NORMAL CHILDREN.

METHOD

SUBJECTS

TWENTY NINE PRETERM CHILDREN WERE RECRUITED FROM A COHORT OF CHILDREN ORIGINALLY ADMITTED TO THE NEONATAL INTENSIVE CARE UNIT OF THE UNIVERSITY OF ALBERTA HOSPITAL. ALL CHILDREN WERE EXAMINED AT 18 MONTHS OF AGE BY A PEDIATRIC NEUROLOGIST USING THE NEUROLOGICAL EXAMINATION OF THE COLLABORATIVE PERINATAL PROJECT (HARDY, DRAGE & JACKSON, 1979). TEN WERE CONSIDERED TO BE NEUROLOGICALLY SUSPECT. OTHERWISE, THEY WERE GENERALLY A HEALTHY GROUP OF PRETERM NEONATES FROM SUPPORTIVE SOCIAL ENVIRONMENTS. DEMOGRAPHIC SUMMARY DATA ARE PRESENTED IN TABLE 1.

TABLE 1. DEMOGRAPHIC DATA

AGE IN MONTHS	53 (4) 43-60
BIRTHWEIGHT IN GRAMS	1733 (440) 870-2440
GESTATIONAL AGE	31.75 (2.5) 27-36
NUMBER OF MALES	13 (45%)
SMALL FOR GESTATION	2 (7%)
NEONATAL ILLNESS	3 (10%)
NEUROLOGICALLY SUSPECT	10 (34%)
SOCIAL CLASS	
PROFESSIONAL	9 (31%)
TECHNICAL	19 (65%)
UNSKILLED	1 (3%)

ASSESSMENT

EACH CHILD WAS SEEN FOR ONE SESSION APPROXIMATELY 1.5 HOURS IN LENGTH. TABLE 2 SUMMARIZES THE ASSESSMENT. MULTIPLE ASPECTS OF LANGUAGE WERE MEASURED UTILIZING SELECTED TOOLS. OUTCOMES WERE CATEGORIZED AS PASS/FAIL BASED ON SPECIFIC CUT-OFF CRITERIA. CUT-OFF CRITERIA ADDRESSED THE CLINICAL SIGNIFICANCE OF EACH CHILD'S PERFORMANCE. A HEARING SCREENING WAS DONE PRIOR TO THE OTHER MEASURES.

TABLE 2. OUTLINE OF ASSESSMENT

ASPECT	MEASURE	OUTCOME	CUT-OFF*
ORAL/MOTOR	ROBBINS/KLEE PROTOCAL	TOTAL FUNCTIONAL SCORE (TFS)	>-1.5 SD
VERBOSITY	12' CONVERSATION SAMPLE	TOTAL WORDS (TOTW)	>-1.5 SD
PHONOLOGICAL	GOLDMAN-FRISTOE TEST OF ARTICULATION	PERCENT CONSONANTS CORRECT (PCC)	< 85%
	12' CONVERSATION SAMPLE		
RECEPTIVE SEMANTICS	PEABODY PICTURE VOCABULARY TEST-R (PPVT-R)	STANDARD SCORE (SS)	>-1.5 SD
EXPRESSIVE SEMANTICS	12' CONVERSATION SAMPLE	DIFFERENT WORDS (DIFFW)	>-1.5 SD
RECEPTIVE SYNTAX	MILLER-YODER LANGUAGE COMPREHENSION TEST (MY)	PERCENT CORRECT (PC)	< 80%
EXPRESSIVE SYNTAX	12' CONVERSATION SAMPLE	DEVELOPMENTAL SENTENCE PERCENTILE SCORE (DSS)	< 10

*ORAL/MOTOR: ROBBINS AND KLEE (1987) PRELIMINARY NORMS
VERBOSITY: SALT DATABASE PROFILER (1992)
PHONOLOGICAL: SHRIBERG AND KWIATKOWSKI (1982)
R.SEMANTICS: PPVT-R NORMS
E.SEMANTICS: SALT DATABASE PROFILER
R.SYNTAX: SHRIBERG AND KWIATKOWSKI (1982)
E.SYNTAX: LEE (1974)

RESULTS

EACH CHILD'S PASSING SCORE WAS THE NUMBER OF ASPECTS PASSED OUT OF A TOTAL OF 7.

TABLE 3 INDICATES THAT ONLY NEUROLOGICAL STATUS AT 18 MONTHS WAS SIGNIFICANTLY CORRELATED WITH SCORE.

MULTIPLE REGRESSION ANALYSIS IN TABLE 4 SERVES TO CONFIRM THE CORRELATION ANALYSIS. NEUROLOGICAL STATUS WAS THE ONLY VARIABLE MAKING A SIGNIFICANT CONTRIBUTION TO PREDICTION OF SCORE.

TABLE 5 INDICATES THAT 85% OF NEUROLOGICALLY NORMAL CHILDREN SCORED 5 OR MORE AND 70% OF NEUROLOGICALLY SUSPECT CHILDREN SCORED 4 OR LESS. TWO NEUROLOGICALLY NORMAL CHILDREN PASSED ALL ASPECTS.

TABLE 6 INDICATES THAT FEWER SUSPECT CHILDREN PASSED EACH ASPECT THAN NORMAL CHILDREN.

ALSO, ORAL MOTOR DEVELOPMENT WAS MOST OFTEN FAILED, FOLLOWED BY R-SYNTAX OR PHONOLOGY, FOR ALL CHILDREN.

FAILURES ON THESE ASPECTS WERE THE MAJOR CONTRIBUTORS TO SCORES OF 6, 5 AND 4 AND THEY CONTINUED TO BE DEFICIENT IN THE PROFILES OF CHILDREN WITH MORE GENERALIZED FAILS.

R-SEMANTICS WAS PASSED BY ALL CHILDREN EXCEPT ONE, WHO FAILED ALL THE ASPECTS.

TABLE 7 INDICATES THAT, IN ADDITION TO FEWER PASSES BY SUSPECT CHILDREN ACROSS ASPECTS, THEIR ACTUAL OUTCOME SCORES WERE ALSO SIGNIFICANTLY LOWER THAN NORMALS FOR FOUR OF THE SEVEN ASPECTS.

TABLE 3. CORRELATION COEFFICIENTS BETWEEN SCORE AND DEMOGRAPHIC VARIABLES.

DEMOGRAPHICS	SCORE
GESTATIONAL AGE	.16205
SEX	-.15486
AGE	-.14738
BIRTH WEIGHT	.23504
SES	-.17247
NEUROLOGICAL STATUS	-.48609**

** P<.01

TABLE 4. MULTIPLE REGRESSION ANALYSIS

VARIABLE	B COEF	SCORES SE	T-VALUE	PROB
BIRTH WEIGHT	.000606	.000681	.890341	.3818
SES	-.59882	.62622	-.956245	.3481
NEUROLOGICAL STATUS	-.1.648387	.618596	-2.664724	.0133
	MULTIPLE R=	.5348		
	STD ERR EST=	1.5596		
	F=	3.3383		

TABLE 5. SCORE DISTRIBUTION BY TOTAL GROUP AND NEUROLOGICALLY NORMAL AND SUSPECT GROUPS.

	SCORES								
GROUP	7	6	5	4	3	2	1	0	M
NORMAL (N=19)	2 (11%)	3 (16%)	11 (58%)	2 (11%)	-	-	1 (5%)	-	5.1*
SUSPECT (N=10)	-	1 (10%)	2 (20%)	3 (30%)	-	2 (20%)	1 (10%)	1 (10%)	3.3
TOTAL (N=29)	2 (7%)	4 (14%)	13 (45%)	5 (17%)	-	2 (7%)	2 (7%)	1 (3%)	4.4

*P<.05

TABLE 6. NUMBER OF CHILDREN IN EACH GROUP PASSING EACH ASPECT.

GROUP	ASPECT						
	VERB	PHONO	R-SEM	E-SEM	R-SYN	E-SYN	ORAL
NORMAL	15 (79%)	13 (68%)	19 (100%)	17 (89%)	13 (68%)	17 (89%)	2 (11%)
SUSPECT	7 (70%)	4 (40%)	9 (90%)	6 (60%)	1 (10%)	6 (60%)	0 -
TOTAL	22 (76%)	17 (59%)	28 (97%)	23 (79%)	14 (48%)	23 (79%)	2 (7%)

TABLE 7. MEANS AND STANDARD DEVIATIONS FOR OUTCOMES BY GROUPS.

GROUP	ASPECT						
	TOTW (VERB)	PCC (PHONO)	PPVT-R SS (R-SEM)	DIFFW (E-SEM)	MY PC (R-SYN)	DSS (E-SYN)	TFS (ORAL)
NORMAL	445* (157)	87* (10)	100 (12)	139* (28)	83* (10)	34 (23)	93 (20)
SUSPECT	290 (167)	78 (12)	91 (22)	94 (33)	45 (33)	37 (30)	91 (20)
TOTAL	392 (174)	85 (14)	98 (17)	124 (37)	70 (27)	35 (25)	92 (20)

*P<.05

CONCLUSIONS

1. PRETERM CHILDREN WHO ARE HEALTHY, NEUROLOGICALLY NORMAL AT 18 MONTHS, AND FROM SUPPORTIVE SOCIAL ENVIRONMENTS, APPEAR TO BE AT RISK FOR AT LEAST MILD LANGUAGE DELAYS AT 4-5 YEARS OF AGE.

2. PRETERM CHILDREN WHO ARE NEUROLOGICALLY SUSPECT AT 18 MONTHS APPEAR TO BE AT RISK FOR MODERATE AND MORE GENERALIZED LANGUAGE DELAYS AT 4-5 YEARS OF AGE. THIS IS REFLECTED IN THE PERCENTAGE OF CHILDREN WITH LOW PASS SCORES AND THE SIGNIFICANTLY LOWER MEAN OUTCOME SCORES FOR SEVERAL ASPECTS.

3. IT IS USEFUL TO ADDRESS BOTH CLINICAL AND STATISTICAL SIGNIFICANCE OF PERFORMANCE.

4. MEASURING MULTIPLE ASPECTS OF LANGUAGE IS IMPORTANT IN DETERMINING WHERE DELAYS ARE MOST PROBABLE.

A. ORAL-MOTOR, PHONOLOGICAL, AND RECEPTIVE SYNTACTIC DEVELOPMENT APPEAR MOST LIKELY TO BE DELAYED. EXPRESSIVE SYNTAX MAY ALSO BE AT MORE RISK. THE DSS DOES NOT INCLUDE A SPECIFIC ANALYSIS OF GRAMMATICAL MORPHEMES AND THEY ARE COMMONLY IN ERROR IN LANGUAGE DELAYED CHILDREN.

B. RECEPTIVE SEMANTICS, SPECIFICALLY LEXICAL COMPREHENSION AS MEASURED BY THE PPVT-R, IS THE LEAST LIKELY TO BE DELAYED.

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