School Placement Outcomes of Young Language Impaired Children

Les conséquences du placement scolaire chez les jeunes enfants avec troubles de langage

Marlene Rissman
Children's Hospital and Health Center
San Diego, CA

Susie Curtiss
Department of Linguistics
UCLA
Los Angeles, CA

Paula Tallal
Center for Molecular and Behavioral Neuroscience
Rutgers University
Newark, NJ

Abstract

Eighty-nine specifically language impaired children, participating in the San Diego Longitudinal Study: Evaluating the Outcomes of Preschool Impairments in Language, were assessed annually over a five-year period. The purpose was to evaluate the extent to which school placement reflects differences in the language and learning profiles of LI children and to determine which age four factors best predict school placement at age eight. Analysis of three school placement groups demonstrated: (1) the number of children in the most severely affected group decreased from age four to eight; (2) children differed initially in expressive language abilities, but increasing group differences emerged over time; and (3) receptive language skills at age four play a predominant role in predicting outcome at age eight.

Résumé

Quatre-vingt-neuf enfants avec troubles de langage spécifiques prenant part à l'étude longitudinale de San Diego sur l'evaluation des conséquences des troubles de langage chez les enfants d'âge préscolaire", ont été évalués annuellement sur une période de cinq ans. L'objectif était de déterminer dans quelle mesure le placement scolaire refléte les différences des profils de langage et d'apprentissage chez les enfants ayant des troubles de langage et d'établir les facteurs reliés à l'âge qui prédisent le mieux le placement scolaire à l'âge de huit ans. L'analyse de trois groupes de placement scolaire a révélé que (1) de l'âge de quatre à huit ans, il y a eu diminution du nombre d'enfants dans le groupe le plus sévèrement touché; (2) bien qu'au début les enfants se distinguaient au niveau de leurs habiletés langagières expressives, des différences croissantes entre les groupes sont apparues avec le temps; et (3) les habiletés langagières réceptives à quatre ans prédisent le mieux les résultats à huit ans.

Preface

In 1980 the San Diego Longitudinal Study was funded by NINCDS to evaluate the multivariate outcomes of preschool impairments in language. This study was designed to yield important theoretical as well as clinical advances to our understanding of the impact of language development and disorders on other areas of a child's development (academic achievement, intellectual attainment, social and emotional development). Being longitudinal in design, this study also was intended to increase our ability to develop profiles representative of various subgroups of language impaired children. The predictive validity of these subgroups then could be assessed directy within the same study based on the subjects' subsequent performance on outcome measures of interest (viz., receptive and expressive language, IQ, emotional profiles, reading, mathematics, etc.). Thus, this study was designed to link many of the current research theories with issues of clinical concern, such as diagnosis, prognosis, and remediation programs.

Three groups of children participated in the longitudinal study. Children with specific developmental language disorder of unknown origin, and age, IQ, and SES matched normal controls were tested annually from four through eight years of age on a detailed battery of neuropsychological (perceptual, motor, cognitive), linquistic (receptive and expressive phonology, morphology, semantics, syntax, and pragmatics), preacademic, and academic achievement (reading, spelling, mathematics) measures. Children matched to the language age of a representative subset of the language impaired group also were included in the study specifically to address the issue of delay versus deviance in language acquisition. The linquistic development of these younger normal children was assessed in depth biannually over a two and a half year period (five data points). Detailed data pertaining to family history of language and learning disabilities, social and emotional development, medical history, current medical status, and preschool placement were collected via questionnaires designed specifically for the study. The San Diego Longitudinal Study was completed in 1989. Results published previously include Curtiss and Tallal (in press), Tallal, Curtiss, and Kaplan (1988), Tallal, Dukette, and Curtiss (1989), Tallal, Ross, and Curtiss

(1989a), and Tallal, Ross, and Curtiss (1989b). Additional reports are currently in preparation. This manuscript reports the results pertaining to school placement outcomes and their prediction.

Introduction

The outcomes of developmental language disorders are of particular clinical as well as theoretical interest. Evidence from longitudinal studies conducted thus far suggests that preschool language impairments may be only the beginning of long standing language, academic, and often behavioral problems (see Tallal, 1988 for review).

Aram and Nation (1980) did a four to five year follow-up study of children initially diagnosed as having developmental speech and language disorders. At follow-up, about 40% of these children continued to have speech or language difficulties, as well as reading and spelling problems. Only about 50% were in a normal class placement. However, inclusion in the study was determined by review of clinic charts, and follow up data was based on parent and teacher report, rather than on empirical test results.

Aram, Ekelman, and Nation (1984) reported their findings of the re-evaluation of 20 language impaired subjects whom they had tested 10 years earlier. Of these original 20, 15 were still experiencing language and/or learning difficulties at the 10 year follow-up. It is important to note, however, that children with IQ scores well below the normal range were included in this study and that the original Leiter scores were found to be the best predictor of over-all performance at re-evaluation. Thus these results need to be interpreted to reflect the outcomes of children with language delay as well as general cognitive impairment.

In their longitudinal study Bishop and Edmundson (1987) evaluated a population of 87 language impaired children at the ages of 4, 4 1/2, and 5 years. They found that 37% of these children had no evidence of language impairment by age 5 years. If only those children with normal nonverbal IQ scores were considered, 44% tested within the normal range on language measures by age 5 years. The authors reported that although test results placed subjects within the normal range on measures of syntax and phonology, a more fine-grained analysis may have revealed more subtle deficits. As well, since the study design did not include follow-up assessments when the subjects were school aged, it was impossible to address the question of whether younger LI children are at risk for future academic difficulties.

Although these studies have enhanced our understanding of long term prognosis and outcome for language impaired children, methodological concerns limit interpretation of these data. Of particular concern is the fact that in many of the studies cited above, retrospective data and data gathered from parent or teacher report were used as the sole source of information. Results of actual speech, language, and reading tests were not always available. Many longitudinal studies reporting outcomes of language impairment have focused on a limited age range. In most studies, younger preschool children were evaluated once, twice, or even three times. Unfortunately, assessment ceased before the early elementary school curriculum could demand reading, spelling, and math skills. It is unclear from these studies whether preschool language problems were eventually resolved or whether subsequent academic difficulties developed. Finally, many outcome studies have included children with IQ scores well below the normal range and, in some cases, with other handicapping conditions as well. If the outcome of language impairment per se is to be evaluated, studies need to be done with children who are free of other developmental disabilities.

As well as considering the outcome of language impairments, evaluating the effectiveness of different therapy programs has been an important issue. Many treatment studies have focused on the efficacy of various intervention strategies with LI children (see Olswang, Bain, & Mateer, 1987, for review). Nye, Foster, and Seaman (1987) reviewed the literature using a meta-analytical procedure to assess the effectiveness of intervention with language and learning disabled children. Forty-three studies were analyzed. Results showed that the average length of treatment was 38 weeks or one school year. Their data suggest that although most intervention occurred in a school setting, the most effective intervention occurred in a clinical setting. Nye et al. emphasized, however, that data interpretation was difficult across these studies because subject populations differed in age, degree of severity, inclusionary criteria, and depth of initial evaluation classifying them as language impaired. Furthermore, conclusions about the effectiveness of long term intervention were precluded by the limited time span of the studies.

While many research studies have evaluated the effectiveness of different language intervention strategies (Olswang et al., 1987) for the developmentally language and learning impaired child, few studies have focused on the profiles of LI children placed in different types of school programs or the language and academic achievement outcomes of LI children attending various school placement programs. Since the vast majority of language impaired children receive intervention primarily or exclusively in a school setting (Nye et al., 1987), it is important to evaluate longitudinally the language and academic achievement outcomes of children in various types of school placement programs. This would allow for a better

assessment of the effectiveness of various class placements, our primary source of remediation for language impaired children.

In the present study a group of four year old children, diagnosed as specifically language impaired, who evidenced no other complications, including hearing loss, oral structure or motor function deficits, frank neurological signs, or mental retardation, were tested annually over a period of five years on an extensive battery of standardized and experimental speech, language, and academic achievement measures. Children who met these criteria were selected to participate in the San Diego Longitudinal Study: Evaluating the Outcome of Preschool Impairments in Language Development (Tallal, Curtiss, & Kaplan, 1988). Strict induction criteria were used to select only children with specific developmental impairments of language, and yearly testing permitted a close evaluation of the performance of these children over the critical years of language development and early academic achievement.

The purpose of the present study was to evaluate the extent to which school placement reflects differences in the language profiles and academic achievement outcomes of language impaired children and to determine which factors at age 4 best predict school placement at age 8.

Methods

Subject Selection

Eighty-nine (89) well defined, specifically language impaired 4 year old children participated as subjects in this study. In an attempt to include a broadly representative sample, school boards, clinics, and private professionals serving language impaired children in San Diego County were asked to refer all children who might meet specified study criteria. Approximately 190 language impaired children were referred and tested by a team of professionals, including a speech-language pathologist, an audiologist, and a clinical psychologist. In addition each child was assessed for autism and neurological impairment by a psychologist and a pediatric neurologist.

Each child had to meet all of the following criteria to be included in the study as a specifically language impaired (LI) subject: (1) age 4.0 - 4.11 at the time of induction; (2) a nonverbal performance IQ of 85 or better on the Leiter International Performance Scale (Leiter, 1940); (3) a mean language age (when computed from standardized receptive and expressive scores) at least one year below both performance mental age and chronological age; (4) normal hearing acuity (no more than 20 db loss in either ear at frequencies of 250-6000 Hz), no motor handicaps, no oral structure or motor impairments affecting nonspeech movements of the articulators; (5) an English language background only, without significant nonstandard dialectal usage or other languages spoken in the home; (6) not autistic (as defined by DSM III-R, 1980); and (7) no known neurological disorders (seizures disorder, hemiparesis, etc.). The Leiter International Performance Scale (Leiter, 1940) was chosen as the IQ measure because it is a nonverbal task and does not penalize the performance of language impaired subjects.

To determine language ability a comprehensive screening battery of receptive and expressive speech and language measures was administered. The battery included the Sequenced Inventory of Communication Development, SICD, (Hedrick, Prather, & Tobin, 1979); a modified form of the Token Test For Children, TT, (DiSimoni, 1978); the Northwestern Syntax Screening Test, NSST, (Lee, 1971); and the Carrow Elicited Language Inventory, CELI, (Carrow, 1974). The Arizona Articulation Proficiency Scale Revised, AAPS, (Fudala, 1980) was used to assess articulation skills. The Token Test for Children was modified by adding nine items to the last section, Part 5. These added items were not used to compute either the raw scores or the age equivalent scores but were added to address specific research questions. In order to keep the test scoring the same as the standard form, five items from each of the first four sections were eliminated, and the remaining items were given a point value of two instead of one.

From the language test scores means were computed which gave a RLA (receptive language age) and an ELA (expressive language age). The mean of these two was computed for each subject and was termed the LA (language age). In order to be included in the study, the LA had to be at least one year behind CA (chronological age) and MA (mental age). MA was based on the Leiter IQ score. Using these tests as criteria to define language impairment proved to be valid in that every child who met the study criteria as language impaired was also diagnosed as such by a speech-language pathologist in a clinic or school setting.

Longitudinal Test Battery

Questionnaires

In year 1 of the longitudinal study, parents were asked to complete a two-page questionnaire detailing the onset of language problems, current and/or previous treatment, and the current status of the language problem. In years 2 to 5 of the study, a current status questionnaire was completed by the parent to document the current status of the language problem and the current school placement. Questions pertaining to place, hours per week, and total months of therapy both during the school year and the summer were documented in this questionnaire. School placement was categorized to include special day class (SDC), pull out programs (PO), and regular

class placement (REG). In addition, the amount of private therapy per week and total number of weeks per year were documented.

For the purpose of this study a child was categorized as being in SDC if the child spent at least four out of the ten months of the school year in a self-contained special education classroom for children with language or learning disorders. A PO placement was one in which the child attended a regular class but was pulled out at least once a week for tutoring in speech and/or language and /or academic subjects. A child was placed in the PO category if he/she was in a pull out program for four months or more of the school year. In the rare case in which a child was in both SDC and PO programs, the SDC category was used. Children who were placed in regular classrooms with no special tutoring or therapy at school were classified as REG. This latter group was comprised of children whose special placement lasted less than four months of the school year.

Speech and Language Assessment

As part of the yearly test battery, both standardized and experimental speech and language measures were given. The standardized measures used to evaluate receptive skills included the Peabody Picture Vocabulary Test Revised (Dunn & Dunn,1981), a modified form of the Token Test for Children (Di Simoni, 1978), and selected subtests from the Clinical Evaluation of Language Function (nos. 1, 6, 9) (Semel & Wiig, 1980). In addition, the Goldman-Fristoe-Woodcock Diagnostic Auditory Discrimination Test Part I (Goldman, Fristoe, & Woodcock, 1974) was used to assess the ability to discriminate speech sounds.

The standardized expressive language measures included the Grammatic Closure subtest of the Illinois Test of Psycholinquistic Abilities Revised Edition (Kirk, McCarthy, & Kirk, 1968), selected subtests of the Clinical Evaluation of Language Function (nos. 10, 11) (Semel & Wiig, 1980), and the Expressive One Word Picture Vocabulary Test (Gardner, 1979). The Arizona Articulation Proficiency Scale (Fudala, 1980) was used to monitor articulation development. From the raw scores, age equivalents were derived. For a more comprehensive description of this battery and the derivation of age scores see Tallal et al. (1988).

The experimental language tool used in the longitudinal assessments was the Curtiss-Yamada Comprehensive Language Evaluation, CYCLE (Curtiss & Yamada, 1980). This is a comprehensive language instrument which assesses linquistic knowledge in all areas of communicative linguistic abilities (i.e., syntax, morphology, semantics, pragmatics, and phonology) from ages 2 to 9 years. Its inclusion in this test battery was important because it provided a consistent, detailed description of language skills each year across the large age range (2 to 9 years) of the Iongitudinal study. The CYCLE consists of four major subbatteries: Receptive Battery (CYCLE-R), Elicitation (CYCLE-E), Spontaneous Speech Analysis, and Phonology. CYCLE-R and CYCLE-E were administered to each subject each year, while Receptive Phonology was assessed yearly until a criterion of 100% correct was reached. The CYCLE-R consists of auditorily presented stimuli requiring a pointing response, with a two, three, or four choice picture arrangement per item. CYCLE-E is an auditorily presented sentence completion task, with each item having it's own stimulus picture(s). The Spontaneous Speech Analysis was used to analyze language samples. Samples were collected during an an informal interview with the tester using a predetermined script, which allowed for consistency across subjects. The analysis consisted of four parts. The morphosyntactic analysis investigated the productive control over a predetermined set of 49. The second analysis examined the semantic roles and relations expressed. The lexical analysis examined productivity and lexical misuse. The pragmatic analysis of conversation included topic related skills and interactive skills; the later included turn taking, repairs, sensitivity to the needs of the listener, and over-all participation in the interaction.

All children completed a language sample in year 1 and selected subjects completed one in each of the remaining four years. A subgroup of LI subjects who represented clinically identifiable populations (i.e., children with predominantly receptive, expressive, or combined receptive/expressive deficits) were selected for annual language sampling procedures. Results of these procedures are still under analysis. For a more detailed description of the CYCLE and an account of the performance of LI and normal children on this measure see Curtiss, Yamada, and Tallal (in press).

Academic Achievement Measures

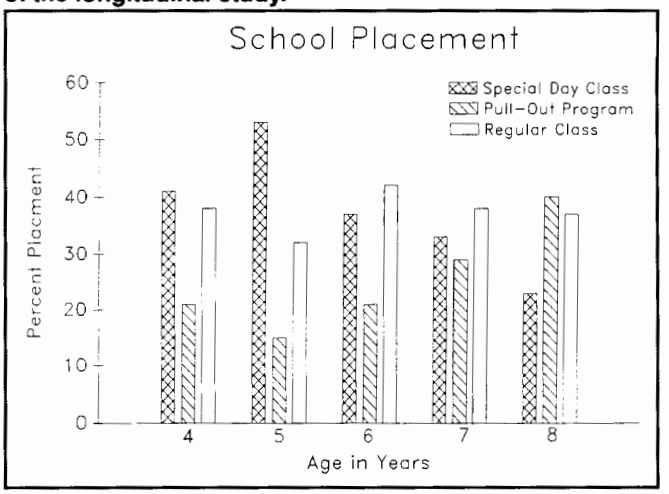
Prereading skills and academic achievement were assessed annually. Prereading skills included visual discrimination (VD), matching letter forms (LF), and selecting letter sounds (LS). Subtests of the California Test of Basic Skills (CTBS) (McGraw-Hill, 1973) were used to assess these prereading skills. The reading vocabulary and reading comprehension subtests of the Gates-MacGinitie Reading Test (Teacher's College, 1964) and the Decoding subtest of the Gates-McKillop- Horowitz Reading Diagnostic Tests (Gates & MacGinite, 1981) were used to assess reading skills. Standardized spelling and mathematics achievement subtests of the CTBS also were given. Each year of the study, from age 4 through 8, all subjects were tested with these measures. Two to three sessions, lasting approximatey three hours each, were needed annually to complete the battery. Consistent reinforcement was given throughout the sessions. Snacks, sticker pictures (Tallal, 1978), and free play time were used.

Table 1. Demographic data and induction measures.

Measure	Mean	*Sd*	Min	Max
Age	4.4	0.3	4.0	4.11
IQ (Leiter)	110	12	85	140
SES *	3.1	1.0	1.0	6.5
RLA	3.2	0.5	2.5	4.4
ELA	3.0	0.2	2.7	3.7
LA	3.1	0.3	2.6	3.9
AAPS	4.2	1.6	3.1	12.0

number of boys 65
number of girls 24
race: Caucasian 83, other (black, hispanic, oriental) 6
* Hollingshead Scale (Hollingshead, 1965)

Figure 1. The percentage of language impaired children in special day classes (SDC), pull out programs (PO), and regular classes (REG) is shown for each of the five years of the longitudinal study.



Results

Means and standard deviations for the induction measures administered at age four years for the 89 children who met all the study criteria for inclusion are shown in Table 1. The final group of LI children was comprised of 65 boys and 24 girls, reflecting the expected higher ratio of boys to girls in the language impaired population (Ludlow & Cooper, 1983). Over the five years of the longitudinal study attrition accounted for the loss of 22 subjects, with 67 subjects completing all five years of the study. Demographic characteristics of the 22 LI children who dropped out of the study were compared to the 67 who completed all 5 years. Results demonstrate that there were no significant differences between the two groups.

By study design, the LI children had nonverbal intelligence scores within the normal range; came from middle class backgrounds, and were between the ages of 4.0 and 4.11 years at the time of induction. The LA, RLA, and ELA of the LI children were approximately 1 to 1 1/2 years behind their chronological and mental ages. Approximately 60% of the children had articulation abilities at least 6 months behind their CA at induction. (See Table 1.)

The percent of subjects placed in each school placement group for each year of the study is shown in Figure 1. In the first year, at age 4, 41% of the children (the largest group) were placed in SDC, 21% (the smallest group) were in PO programs (small group speech/language therapy two to three times per week for one to two hours), and 38% received no special placement. In kindergarden (year 2, age 5), approximately half (53%) of the children were placed in a SDC program, while 15% were in PO programs and 32% were in REG. In the third year, 37% were in SDC programs, while 21%, again the smallest group, were placed in PO programs and 42% in REG. In the fourth year of the study, 33% were placed in SDC classes, 29% in PO programs, and 38% in REG. By the end of the study (year 5, age 8) and for the first time, the highest percent of placements was in PO programs (40%), followed by REG placement (37%), and SDC placement (23%). Over the five years of the study, the number of children in SDC placements shows a declining trend, while PO placements show an increasing trend. The number of REG placements remains approximately the same.

In order to look at the profiles of children placed in these different school programs for each year of the study, the SES, language, and academic achievement measures were analysed for each placement group using a one way analysis of variance (ANOVA). IQ results for years 1 and 5 were analysed in the same way. Statistically significant differences are shown separately for each year in Table 2.

As can be seen in Table 2, the results of the ANOVA demonstrated that there were no significant differences between school placement groups for age, IQ, or SES in year 1 of the study when the children were 4 years old. Further analysis of year 1 data demonstrated that the only significant performance difference between 4 year old LI children in different school placement programs was in expressive language ability. The mean ELA was significantly different between groups. The results of a Student Newman-Keuls procedure showed that LI children in REG classes had a significantly higher ELA than children in both PO and SDC placements. Similarly, the REG group reached significantly higher levels than the SDC and PO groups on the CYCLE-E.

Table 2. Significant performance differences between LI children in different school placement groups.

YEAR 1

ELA $F(2,75) = 9.1$, $p < 0.001$; CYCLE-E $F(2,61) = 4.9$, $p < 0.002$

Group	Mean	*SD*	Mean	*SD*
SDC	2.9	0.17	1.7	0.90
PO	2.9	0.20	1.7	0.78
REG	3.1	0.24	2.6	1.38

YEAR 2

CYCLE-E $F(2,69) = 6.2$, $p < 0.004$)

Group	Mean	*SD*
SDC	2.7	1.4
PO	4.2	1.3
REG	3.5	1.4

YEAR 3

CYCLE-R $F(2,62) = 17.4$, $p<0.0001$; CYCLE-E $F(2,61) = 12.2$, $p<0.0001$

Group	Mean	*SD*	Mean	*SD*
SDC	3.2	1.0	3.0	1.4
PO	4.9	1.2	4.4	1.4
REG	4.6	1.0	4.8	1.2

YEAR 4

RLA $F(2,59) = 4.8$, $p<0.02$; ELA $F(2,59) = 5.5$, $p<0.01$

Group	Mean	*SD*	Mean	*SD*
SDC	5.8	1.0	6.4	1.0
PO	6.6	1.0	7.2	1.0
REG	6.8	1.3	7.2	0.8

LA $F(2,59) = 6.1$, $p<0.004$; CYCLE-E $F(2,56) = 6.4$, $p<0.004$

Group	Mean	*SD*	Mean	*SD*
SDC	6.1	0.9	3.9	1.6
PO	6.9	0.9	5.2	1.4
REG	7.0	1.0	5.1	0.9

VOC $F(2,58) = 3.5$, $p<0.04$; COMP $F(2,59) = 3.5$, $p<0.04$

Group	Mean	*SD*	Mean	*SD*
SDC	4.4	13.3	3.3	14.4
PO	20.5	31.9	16.3	23.9
REG	27.3	37.3	23.9	34.3

Table 2. Continued.

YEAR 5

RLA $F(2,57) = 23.1$, $p<0.001$; ELA $F(2,57) = 17.0$, $p<0.001$

Group	Mean	*SD*	Mean	*SD*
SDC	5.8	0.8	6.9	1.1
PO	7.6	1.3	8.4	0.9
REG	8.3	1.0	8.7	0.9

LA $F(2,57) = 25.7$, $p<0.001$; CYCLE-R $F(2,54) = 5.1$, $p<0.01$

Group	Mean	*SD*	Mean	*SD*
SDC	6.4	0.8	5.1	1.6
PO	8.0	0.9	5.9	1.4
REG	8.5	0.9	6.7	1.2

CYCLE-E $F(2,57) = 5.1$, $p<0.01$; CTBS VD $F(2,56) = 4.4$, $p<0.02$

Group	Mean	*SD*	Mean	*SD*
SDC	4.2	1.5	15.1	3.7
PO	5.8	1.3	16.8	1.6
REG	5.9	2.0	17.3	1.1

SPELL $F(2,57) = 5.2$, $p<0.01$; VOC $F(2,57) = 3.5$, $p<0.04$

Group	Mean	*SD*	Mean	*SD*
SDC	3.5	7.6	5.9	21.9
PO	21.5	29.8	12.5	24.5
REG	35.7	36.1	30.4	40.0

IQ $F(2,57) = 17.4$, $p < 0.001$

Group	Mean	*SD*
SDC	104	10.4
PO	109	9.4
REG	114	13.9

In the second year of the study, expressive language measures again were the only variables that significantly differentiated between school placement groups. The highest level passed on the CYCLE-E was significantly different between school placement groups. A Student Newman-Keuls analysis showed that both the PO and REG groups passed significantly higher levels on the CYCLE-E than the SDC group.

In year 3, when the LI children were 6 years old, both receptive and expressive language measures significantly differentiated between groups. On the CYCLE-R both PO and REG groups reached significantly higher levels than the SDC

Table 3. Discriminant function analysis predicting year 5 school placement from year 1 data.

Classification matrix: Percent correctly predicted from year 1 data

Actual Group	Predicted Group Membership		
(Year 5)	**SDC**	**PO**	**REG**
SDC	78.6%	7.1%	14.3%
PO	12.5%	50%	37.5%
REG	20%	30%	50%

group. Similarly for the CYCLE-E, both REG and PO groups outperformed the SDC group. None of the prereading or academic achievement measures proved significantly different between groups.

When the LI children were 7 years old, in the fourth year of the study, language measures again proved significantly different between groups. For RLA, ELA, LA, both the PO and REG groups demonstrated significantly better language skills than the SDC group. On the experimental language measures, only the CYCLE-E significantly differentiated between groups, with the REG and PO groups performing significantly better than the SDC group. None of the prereading tests significantly discriminated between groups. However, for the first time, reading measures effectively differentiated between school placement groups. Reading vocabulary and reading comprehension proved to be significantly different between groups. In both cases, the REG group's performance was significantly better than the performance of the SDC group. The large standard deviations on the academic outcome measures reflect the variability in performance of the individual subjects within each group.

In the fifth and final year of the study, when the children were 8 years old, many variables significantly differentiated between school placement groups. The REG and PO groups performed significantly better than the SDC group on RLA, ELA, LA, CYCLE-E, the prereading visual discrimination (VD) subtest, and IQ. For RLA, LA, and IQ, the REG group outperformed the PO group. For spelling and CYCLE-R, the REG group performed significantly better than the SDC group. For reading vocabulary, the REG group outperformed both the SDC and PO groups. As in year 4, variability in performance on the academic measures is reflected by the large standard deviations. (See Table 2.)

Year 1 Predictors

Because early intervention is strongly recommended for children with language impairments, early identification of LI children who are most at risk for later language and learning difficulties is of particular concern to both parents and clinicians. Therefore, data collected in year 1 of the study, when the LI children were 4 years old, were analysed to determine which variables were best able to predict subsequent school placement outcomes in year 5, when the children were 8 years old. Year 1 data on IQ, SES, sex, SICD (R&E), CELI, NSST (R&E), TT, and AAPS were used as predictor variables in a discriminant function analysis, with the year 5 school placement groups being used as the outcomes of interest. Results of this analysis showed that six year 1 variables, when taken in combination, correctly predicted 78.6% of the SDC placements for the LI children in year 5 of the study. These variables, in order of importance, were SICD-R, NSST-R, SES, NSST-E, CELI, and IQ. Age 4 test scores were less successful in predicting class placement for those LI children who were in the REG and PO placements at age 8 . Only 50% were correctly predicted for each of these two groups based on the six year 1 variables. Overall prediction from year 1 data to year 5 placement was 57% for all three groups. Table 3 shows these results.

Questionnaire Data

Data from yearly parent questionnaires provided information about the number of LI children receiving therapy each year for language and/or reading problems in a private clinic or other private setting. In year 1, of the 89 children who were included in the study, only 21% (18) received private therapy. Of these, only 11% (10) were in therapy for 4 months or more. In year 2, with 83 children remaining in the longitudinal study, 22% (18) received some private therapy, but only 16% (13) did so for 4 months or more. Data from the year 3 questionnaire showed that 10%, or 8 out 77 children, had some private therapy, but only 9% (7) for 4 months or more. In year 4, with 71 children remaining in the study, only 10% (7) received therapy, and all of these for 4 months or more. In the fifth and final year, 13% (9) of the remaining 67 children received therapy, with only 9% (6) for 4 months or more.

Due to the fact that the percentages of LI children receiving private therapy in each year of the study was very small and that even fewer received therapy for four months or more, and, due to the difficulty of documenting and comparing different therapy programs, it is not possible from the data collected through our parent report questionnaires to draw conclusions about the nature or degree of change in language skills effected by private therapy. Further investigation into this area is warranted with a format that includes collections of therapy information directly from the provider.

Discussion

The results of this study clearly show that several experimental and standardized test measures used in the San Diego Longitudinal Study significantly discriminated between LI children in different class placement programs during each of the five years of the study. In each year, expressive language measures consistently discriminated between school placement groups, suggesting that a LI child's expressive language output may be the factor used most often by school officials to determine school placement for LI children. This was the case particularly for the youngest LI children. In fact, in the first two years of the study, when the subjects were 4 and 5 years old, the *only* variables that significantly differentiated between school placement groups were expressive language measures. The school placement groups were not significantly different at the outset of the study in age, IQ, SES, or receptive language ability.

One of the major questions asked in the San Diego study was which year 1 profile best predicted year 5 outcome. Such a profile would allow those children most at risk for later academic difficulties to be identified at age 4. Results suggest that placements for approximately 80% of the most severely affected LI children, those who were still in an SDC placement by year 5, were correctly predicted by six year 1 variables. In light of the annual data, the results of the discriminant function analysis are particularly interesting. They demonstrate the predominant role of *receptive* language tests at age 4 in predicting school placement at age 8, particularly for those children who were in the worst outcome group (SDC). These data taken in combination suggest that although school officials may be focusing primarily on expressive language abilities to determine class placement for young LI children, it may be that receptive language abilities actually play a greater role in predicting which LI children are most at risk for long-term language and learning disorders. Furthermore, although the placement groups did not differ at age 4 in either IQ or SES, both SES and IQ at age 4 contribute to the power of prediction of age 8 school placement outcomes. Thus, these results suggest that when young children are evaluated for school placement programs, both receptive and expressive language abilities as well as IQ and SES must be considered in determining which children may be most at risk for long-term placement in SDC programs.

The results of this study also increase our understanding of the relationship between language and other learning disabilities. The LI children in the different school placement groups were well matched at the onset of the study at age 4, except for their expressive language abilities. However, as the years passed, LI children placed in different school placement programs became increasingly differentiated from each other in areas other than expressive language. By the fourth and fifth years of the study, the three placement groups differed significantly on almost all of the abilities tested. Notably, in addition to language measures, spelling, reading vocabulary and comprehension, and nonverbal IQ measures also differentiated between school placement groups in year 5 when the LI children were 8 years old. Interestingly, the children were not significantly different on math abilities.

It is not possible from this study to determine the relationship between oral language and academic deficits. It appears, however, that the LI children who remained in SDC placements had significantly more difficulty learning to read and spell than those in the PO and REG placements. It is not clear whether progress in learning to read and spell was a significant variable affecting class placement decisions over the years. For whatever combination of reasons a child was kept in an SDC program, the outcome of those LI children who remained in SDC placements during the years of the study was worse than those in PO and REG placements. By age 8 years the LI children in the SDC programs were not only more impaired in language than the children in the PO and REG programs, but also more impaired in reading and spelling as well as in nonverbal IQ. Even though there were no significant group differences in nonverbal IQ at age 4, by age 8 the LI children in the SDC, PO, and REG placement programs showed significant inter-group differences on nonverbal IQ scores.

These data may suggest that the SDC placements are in fact serving those LI children who are most impaired and most in need. Further interpretation of these results and their value in predicting academic outcome will be enhanced by a more detailed analysis, which is the topic of a forthcoming manuscript (Tallal, Allard, & Curtiss, in preparation).

Conclusions

In conclusion, the results of this longitudinal study reveal several significant findings pertaining to the outcomes of LI children placed in different school programs. First, the percentage of LI children placed in SDC programs decreased from age 4 to age 8, while the percentage placed in PO programs increased. The percentage in REG class placement remained about the same. Secondly, although school officials may be relying primarily on expressive language abilities to determine school placement for young LI children, a discriminant function analysis demonstated the important role of receptive as well as expressive language abilities, and of SES and IQ in predicting long-term school placement outcomes. Finally, whereas young LI children in various school placement programs differ only on expressive language measures, as they get older, the differences between LI children placed in various school placement programs increase dramatically.

These differences encompass not only oral language abilities, but reading, spelling, and IQ as well.

It was not the intent of this research study to evaluate the effects of private therapy for LI children. It is interesting to note, however, that only a small percentage of children were enrolled in private therapy each year, and an even smaller number for four months or more per year. These findings support those of Nye et al. (1987) which show that most LI children receive therapy within the school setting.

It is important to note that it was not within the scope of this study to address either the effects of treatment or the effectiveness of one school placement program over the others for LI children. It likewise was not the aim of this study to track children individually over the years of the study, but to look at groups of LI children. What the study does suggest is that there are clear differences between LI children placed in SDC, PO, and REG programs, and that these differences change over the course of development. The differences are much greater and more significant among the LI children placed in various school programs at age 8 than they are at age 4. Thus, the relevant issues and criteria used for making decisions about school placement programs for LI children also must be different for children of different ages.

The results of this longitudinal study make clear the increasing differences in the profiles of LI children in various school placement programs through the preschool and early elementary school years. There is strong evidence to suggest that some young LI children are at risk for later academic difficulties, as well as continued language deficiencies. The findings of Nye et al. (1987), which show that most intervention for LI children occurs in a school setting, combined with the results of this longitudinal study, which demonstrate progressively more significant differences between LI children in different placement programs, suggests that further research is needed to identify the variables which determine school placement and to evaluate the effectiveness of various school placement programs for LI children, as well as the long-term outcomes for LI children placed in these programs.

Acknowledgements

This study was supported by a contract from NINCDS, N01-NS-9-2322. We appreciate the help of Dr. Robert Kaplan and Christine Justice, M.A., in statistical analysis, and William Lewis, M.D., Mary Zeigler, Jean Stringer, M.A., Janie Belasco, Rachel Greenberg, and Leah Seki in subject selection and testing. We are indebted to the parents and teachers who cooperated with this study and to the children who participated.

Requests for reprints and all correspondence concerning this manuscript should be sent to:
Paula Tallal, Ph.D.
Rutgers University
Center for Molecular and Behavioral Neurosciences
195 University Ave.
Newark, NJ 07102
USA

References

Aram, D.M., Ekelman, B.L., & Nation, J.E. (1984). Preschoolers with language disorders:10 years later. Journal of Speech and Hearing Research, 27, 232-244.

Aram, D.M., & Nation, J.E. (1980). Preschool language disorders and subsequent language and academic difficulties. *Journal of Communication Disorders, 13*, 159-170.

Bishop, D.V.M., & Edmundson, A. (1987). Language-impaired 4 - year olds: Distinguishing transient from persistent impairment. *Journal of Speech and Hearing Disorders, 52*, 156-173.

Carrow, E. (1974). Carrow Elicited Language Inventory (CELI). Hingham, MA: Teaching Resources.

Curtiss, S., & Tallal, P. (in press). On the nature of the impairment in language impaired children. In J. Miller (Ed.), *New directions in research on child language disorders. Boston, MA: College Hill Press.*

Curtiss, S., & Yamada, J. (1980). Curtiss and Yamada Comprehensive Language Evaluation (CYCLE). Unpublished.

Curtiss, S., Yamada, J., & Tallal, P. (in press). The CYCLE: A description and it's use with language impaired children. *Journal of Speech-Language Pathology and Audiology.*

Disimoni, S. (1978). Token Test for Children. Hingham, MA: Teaching Resources.

Dunn, L.M., & Dunn, L.M.(1981). Peabody Picture Vocabulary Test Revised (PPVT-R). American Guidance Service, Circle Pines, MN.

Fudala, J.B. (1980). Arizona Articulation Proficiency Scale: Revised (AAPS). Western Psychological Services, Los Angeles, CA.

Gardner, M. (1979). Expressive One-Word Picture Vocabulary Test. Academic Therapy Publications, Novato, CA.

Gates, A., & MacGinite, W.H. (1964). Gates-MacGinite Reading Tests. Teachers College Press, Columbia University, N.Y.

Gates A., Mckillop, A.S., & Horowitz,E.C. (1981). Gates-McKillop-Horowitz Reading Diagnostic Tests. Teachers College Press, New York, N.Y.

Goldman, R., Fristoe, M., & Woodcock, R. (1974). Goldman-Fristoe-Woodcock Diagnostic Auditory Discrimination Test. Circle Pines, MN.

Hedrick,D.L., Prather, E.M., & Tobin, A.R. (1979). Sequenced Inventory of Communication Development (SICD). University of Washington Press, Seattle, WA.

Hollingshead, A. B. (1965). Two Factor Index of Social Position. New Haven, Connecticut: Yale Station.

Kirk, S.A., McCarthy, J.J., & Kirk, W.D. (1968). Illinois Test of Psycholinquistic Abilities. Western Psychological Services, Los Angeles, CA.

Lee, L. (1969). Northwestern Syntax Screening Test (NSST). Northwestern University Press, Evanston, IL.

Leiter, R. (1940). The Leiter International Performance Scale. Santa Barbara, State College Press.

Ludlow, C.L., & Cooper, J.A. (1983). *Genetic aspects of speech and language disorders*. New York: Academic Press.

MacGinite, W.H. (1978). Gates-MacGinite Reading Tests, 2nd Edition. The Riverside Publishing Company, Chicago, IL.

Mcgraw-Hill, (1973). Comprehensive Test of Basic Skills (CTBS). Del Monte Research Park, Monterey, CA.

Nye, C., Foster, S.H., & Seaman, D. (1987). Effectiveness of language intervention with the language/learning disabled. *Journal of Speech and Hearing Disorders, 52*, 348 -357.

Olswang, L.B., Bain, B.A., & Mateer, C. (1987). Report to Congress on Children with Developmental Language Disorders: Language Intervention Research.

Semel, E.M., & Wiig, E.H. (1980). Clinical Evaluation of Language Functions (CELF). Charles E. Merrill Publishing Company, Columbus, OH.

Tallal, P. (1978). A novel reinforcement procedure for use in perceptual experiments with normal and language-impaired children. *Perceptual and Motor Skills, 47*, 264-266.

Tallal, P. (1988). Developmental language disorders: Part I, definitions. *Human Communications Canada, 12* (2), 7-22.

Tallal, P., Curtiss, S., & Kaplan, R. (1988). The San Diego Longitudinal Study: Evaluating the Outcomes of Preschool Impairment in Language. In S.E. Gerber & G.T. Mencher (Eds.), *Human communication disorders: A worldwide perspective*. Gallaudet University Press.

Tallal, P., Dukette, D., & Curtiss, S. (1989). Behavioral/emotional profiles of preschool language-impaired children. *Development and Psychopathology, 1*, 51-67.

Tallal, P., Ross, R., & Curtiss, S. (1989a). Familial aggregation in specific language impairment. *Journal of Speech and Hearing Disorders, 54*, 167-173.

Tallal, P., Ross, R., & Curtiss, S. (1989b). Unexpected sex-ratios in families of language/learning-impaired children. *Neuropsychologica, 27* (7), 987-998.

Tallal, P., Allard, L., & Curtiss, S. (in preparation). Academic outcomes of preschool language impairments: Results from the San Diego Longitudinal Study.