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Rhea Paul

Sacred Heart University, paulr4@sacredheart.edu

Timothy F. Lynn

Marla Lohr-Flanders

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History of Middle Ear Involvement and Speech/Language Development in Late Talkers

Research Note

Rhea Paul

Portland State University
Portland, OR

Timothy F. Lynn

Groner School District
Hillsboro, OR

Marla Lohr-Flanders

Arkansas Health Department
Little Rock, AR

Late-talking and normally speaking toddlers with and without histories of middle ear involvement were followed for 2 years to assess speech and expressive language outcomes. Results revealed no differences in expressive language outcome that could be attributed to history of middle ear involvement in either group. There did seem to be differences in outcome on measures of articulation that were associated with history of middle ear involvement. The implications of these findings for treatment of otitis media and for referral of late-talking toddlers for speech and language services are discussed.

KEY WORDS: otitis media, language delay, phonological delay

The degree of increased risk for speech and language disorder in children with a history of otitis media has become a matter of debate in recent literature. Roberts, Burchinal, Davis, Collier, and Henderson (1991) provide an extensive review of this literature and a discussion of some of its methodological problems. Briefly, many studies have reported adverse effects on various aspects of speech (Holm & Kunze, 1969; Hubbard, Paradise, McWilliams, Elster, & Taylor, 1985; Lehmann, Charron, Kummer, & Keith, 1979; Needleman, 1977; Paden, Novak, & Beiter, 1987; Roberts, Burchinal, Koch, Footo, & Henderson, 1988; Schlieper, Kisilevsky, Mattingly, & Yorke, 1985; Shriberg & Smith, 1983; Silva, Kirkland, Simpson, Stewart, & Williams, 1982) and language (Downs, Walker, & Northern 1988; Friel-Patti & Finitzo, 1990; Friel-Patti, Finitzo-Hieber, Conti, & Brown 1982; Menyuk, 1986; Teele, Klein, Rosner, & the Greater Boston Otitis Media Group, 1984; Wallace, Gravel, McCarton, & Ruben, 1988) associated with chronic otitis media, although frequently these studies look only at effects in the first 2 years of life (e.g., Friel-Patti & Finitzo, 1990; Wallace, Gravel, McCarton, & Ruben, 1988). In longer-term follow-up studies, effects do not always persist (Gravel & Wallace, 1992; Teele et al., 1984). Effects are often statistically significant but of questionable functional significance (Friel-Patti & Finitzo, 1990; Roberts et al., 1988). Moreover, other researchers (Bishop & Edmundson, 1986; Fischler, Todd, & Feldman, 1985; Greville, Keith, & Laven, 1985; Roberts et al., 1991; Roberts et al., 1986) report no important differences between the verbal skills of children who do and do not have histories of otitis media. Bishop and Edmundson (1986) and Roberts and Schuele (1990) point out, however, that whereas otitis media alone may not constitute an increased risk for language disorder, it may interact with other risk factors in vulnerable children.

The present report examines history of middle ear involvement as a possible factor associated with increased risk for communicative handicap in a group of children with a vulnerability for language delay: "late talkers." These otherwise normal toddlers fail to begin speaking and have small expressive vocabularies throughout the second and third years of life. Although they are often considered "late bloomers" who will

eventually show normal language ability, several recent studies (Paul, 1991; Rescorla & Schwartz, 1990; Thal, 1989) suggest that they are at substantial risk for continued language delay. We were interested in exploring factors that might contribute to this risk.

The history of otitis media was examined only retrospectively in this study. We did not see these children until they were at least 20 months of age. It should also be emphasized that the present study is very limited in scope because the project was not originally designed to assess otitis media as a contributory factor in early language delay. Only when parents of late talkers began to speak with us about it did we make an attempt to explore its role. At intake into the longitudinal study, we asked parents to fill out a general medical history questionnaire. One question asked parents to indicate how many times before their first visit to us their physician had diagnosed an ear infection in their child and whether the child had ever had tubes placed in the ears. In talking to parents of our late talkers in the course of filling out this questionnaire, we often heard the parents say that they believed their children were slow to begin talking because they had had so many ear infections during their first 2 years. The data available for this report are, admittedly, flawed by possible lapses in the parents' memory and the lack of concurrent information on effusion, length of episode, and effects on hearing during and following the episode. Friel-Patti and Finitzo (1990), for example, suggest that the relationship between otitis media and language development is mediated by hearing level. Such effects would not be recoverable in a study employing retrospective data, as ours does. Thus the implications of this study are constrained by its retrospective nature, by the limited quality of the data available, and by the small part otitis and hearing played in the larger study of this cohort.

Our interest, though, was in looking at history of middle ear involvement as one possible factor that might contribute to risk for continued speech and language delay in a group of late talkers already considered vulnerable for chronic deficits. As such, the kind of data we report here is very similar to the kind a clinician taking a medical history from parents of a toddler with suspected language problems will encounter. We expect that clinicians will have experiences similar to ours with these parents. That is, the parents will tend to blame the child's language delay on the history of ear infections. We were interested in testing the parents' hypothesis, using the kind of data that will usually be available in real clinical situations. Such data could be used in two ways: First, they could answer the question whether, as the parents suspect, late talkers have more ear infections than other toddlers and whether the frequent ear infections could serve as an explanation for the language delay. Second, these data could be used to examine whether there were any relationship between history of middle ear involvement as parents recall it and continued risk for language deficit later in the preschool period.

If parental report of middle ear involvement does relate to language outcomes for children who are late to begin talking, then early, aggressive treatment of the middle ear pathology may be sufficient to prevent chronic delay in these children. If, on the other hand, history of middle ear involvement does

not seem to be a factor in determining who "grows out" of early language delay and who does not, then clinicians might be less willing to rely primarily on treatment of otitis media to overcome these delays in toddlers. Although the retrospective data presented here are not as precise or elaborated as data from other studies of otitis media, we do look at data that are clinically relevant in a population known to be at risk. As such, the present report can contribute to decision-making about early intervention for at-risk children who present with a history of frequent ear infections, as reported by parents.

Method

Subjects

The children in this study are a subset of those participating in the Portland Language Development Project (PLDP), a longitudinal study of outcomes of early expressive language delay. Subjects for PLDP were recruited from children attending well-baby visits at several large pediatric practices, as well as through newspaper and radio advertisements. Subjects were between 20 and 34 months of age at entrance into the study.

Children were placed in normal versus late talking (LT) groups on the basis of their expressive vocabulary size as reported by parents on the Language Development Survey (LDS) (Rescorla, 1989) at intake into the PLDP. The LDS has been reported to show excellent validity, reliability, sensitivity, and specificity in identifying children with language delay in the third year of life. Children who at 20 to 34 months of age used fewer than 50 words were assigned to the LT group. Those at 20 to 34 months with more than 50 words were assigned to the normal group. Average expressive vocabulary size on the LDS for the normal group was 224.0 words (*SD* 68.2). For the LT group average expressive vocabulary size was 22.0 (*SD* 22.1). About one-third of the LT subjects showed some delay in receptive language abilities, but they generally scored within 6 months of age level on the Reynell Receptive Language Scales (Reynell, 1984). All normal subjects scored within the average range of receptive skills on this measure. (See Paul, Spangle-Looney, & Dahm, 1991, for details). The groups were matched on the basis of age, sex ratio, socioeconomic status, and birth order. Demographic comparisons between the two groups at the initial evaluation, at age 20 to 34 months, are given in Table 1.

As part of the longitudinal study, subjects were seen yearly for follow-up evaluations of speech and language. Twenty-three LT subjects were available for follow-up at both ages 3 and 4. Twenty-one normal subjects participated in both follow-up evaluations. Speech and expressive language outcome at ages 3 and 4 were examined at the follow-up assessments, using standardized measures and language sampling. Intervention history for this cohort are presented in Paul and Smith (1993).

For the purpose of the present report, subjects in each diagnostic group (normal and LT) were subdivided into two groups based on parental report of history of middle ear involvement. In each diagnostic group, two subgroups were

TABLE 1. Subjects' demographic characteristics.

| | Normal Talkers | Late Talkers |
|---|----------------|--------------|
| Mean age (and <i>SD</i>) in months at time of first evaluation | 25.6 (4.2) | 26.7 (3.6) |
| Proportion of males | 62% | 83% |
| Proportion of first-borns | 40% | 36% |
| Mean (and <i>SD</i>) SES* | 2.3 (1.4) | 2.9 (1.1) |
| Proportion of subjects from nonwhite racial groups | 4.5% | 4.3% |

*Based on Myers & Bean's (1968) adaptation of the Hollingshead four-factor scale of social position, on a scale from 1 to 5 with 1 being the highest and 5 the lowest.

identified: one with a history of middle ear involvement (Hx+), and one without such a history (Hx-). Middle ear involvement was construed, following Shriberg and Smith (1983), to denote frequent ear infections that were treated by a physician, as reported by parents, or the placement of ventilation tubes, which was taken as evidence of a physician's perception of chronic middle ear difficulties. More specifically, for the purposes of this report we defined middle ear involvement to mean *either* the placement of myringotomy tubes *or* the presence of six or more ear infections treated by a physician before the second birthday, by parent report. Lack of such history was defined as parental report of four or fewer ear infections treated before age 2 and no placement of myringotomy tubes. Of the children assigned to the Hx- group, 91.6% had two or fewer ear infections during their first 2 years; 95.8% had 3 or fewer. Table 2 shows the results of the parental report of middle ear involvement for each of the four subgroups.

These criteria represent, admittedly, a very rough estimate of history of otitis media and make no effort to account for presence or absence of effusion, length of the episode, or decrement in hearing acuity during the episode. The purpose of choosing such a broad approximation of otitis media history is that this is just the sort of history a clinician is likely to encounter in practice, and it is our intention to provide the clinician with information that will be useful in making decisions about what to treat and what to recommend to families

TABLE 2. Number of ear infections reported by parents in normal-talking and late-talking toddlers with positive (Hx+) and negative (Hx-) histories of middle ear involvement.

| Group | Number of subjects | Mean | SD |
|----------------|--------------------|------|-----|
| Normal Talkers | | | |
| Overall | 21 | 4.6 | 4.7 |
| Hx+ | 8 | 9.6 | 3.8 |
| Hx- | 13 | 1.5 | 0.9 |
| Late Talkers | | | |
| Overall | 23 | 6.4 | 5.9 |
| Hx+ | 12 | 10.8 | 4.9 |
| Hx- | 11 | 1.7 | 1.1 |

seeking advice about late-talking toddlers, when the issue of middle ear involvement arises.

Procedures

All subjects were given speech reception screenings at 20 dB, following ASHA (1985) guidelines, using visually reinforced audiometry in a sound field in a sound-treated booth by a certified audiologist, at the first evaluation, when the Language Development Survey (LDS) was completed. A Maico model 24B audiometer calibrated to ANSI (1969) standards was used. All subjects included in the study being reported here passed these screenings, although some subjects in the larger cohort did not. All subjects were also given tympanograms by an audiologist at the same session. As part of this examination, the audiologist noted whether ventilation tubes were in place. Between 15 and 33% of the children in each of the four subgroups had abnormal tympanograms at this visit, indicating the possibility of acute otitis media in a large proportion of subjects in all groups. Whitehurst, Smith, Fischel, Arnold, and Lonigan (1991) also report that both normal and late-talking toddlers like the ones in this study frequently present with abnormal tympanograms, as well as with mild conductive hearing losses, as other subjects (not included in the present report) in our cohort did. Roeser, Soh, Duckel, and Adams (1978) reported that these findings were typical of a random sample of normal preschoolers, as well. We did not eliminate toddlers with abnormal tympanograms so long as they passed hearing screening at 20dB, because this would have eliminated such a large number of subjects. Further, to do so seemed overly restrictive in that the literature suggests abnormal tympanograms are prevalent in this population.

At in-take, all subjects were given intensive testing in language and related areas. Also, parents filled out medical history questionnaires, from which the data on number of ear infections and placement of ventilation tubes were gathered.

The subjects were seen for follow-up evaluations at age 3 and again at 4. To assess articulation performance, the Goldman-Fristoe Test of Articulation (1969) was administered to each subject at age 3, and the Word Articulation subtest of the Test of Language Development-Primary (Newcomer & Hammill, 1988) was given at age 4. To assess expressive language skill, a sample of free speech was collected during a 15-minute play interaction between the mother and child at ages 3 and 4. Speech samples were recorded on audiotape and transcribed into the SALT computer program (Miller and Chapman, 1985). The SALT program was used to compute mean length of utterance (MLU) in morphemes for each sample of speech collected.

Reliability

Reliability for the Goldman-Fristoe and TOLD Word Articulation tests was determined by having a second scorer present during the administration of 10% of the test sessions, independently scoring each child's articulation during the administration. Reliability of scoring for the Goldman-Fristoe was 90%. For the Word Articulation subtest of the TOLD it

TABLE 3. Mean (and SD) speech and language scores for subjects by subgroups with positive (Hx+) and negative (Hx-) history of middle ear involvement.

| Subgroup | No. | Age 3 | | Age 4 | |
|-----------------------|-----|-------------|----------------------|-------------|-----------------------------|
| | | MLU | Goldman-Fristoe %ile | MLU | TOLD Word Articulation %ile |
| Normal Talkers | | | | | |
| Overall | 21 | 4.12 (1.11) | 61.5 (31.9) | 4.63 (0.73) | 55.5 (33.1) |
| Hx+ | 8 | 4.26 (1.56) | 58.9 (33.0) | 4.82 (0.32) | 57.1 (26.0) |
| Hx- | 13 | 4.05 (0.85) | 62.3 (32.4) | 4.55 (0.89) | 54.5 (37.8) |
| Late Talkers | | | | | |
| Overall | 23 | 2.51 (0.69) | 15.5 (15.8) | 3.99 (1.05) | 24.9 (24.6) |
| Hx+ | 12 | 2.42 (0.60) | 12.3 (10.8) | 4.08 (1.05) | 17.8 (19.0) |
| Hx- | 11 | 2.61 (0.79) | 18.9 (19.8) | 3.91 (1.09) | 31.6 (28.6) |

was 92%. Reliability for transcription of the speech samples was computed by having a second transcriber independently transcribe 10% of the samples. The middle one hundred words of the two transcriptions of these samples were compared. Reliability was computed using a point-to-point (word-to-word) method (McReynolds & Kearns, 1983). For the transcriptions of the 3-year-olds' samples reliability was 91%. For the 4-year-olds' samples it was 97%. Reliability of the assignment of bound morphemes entered into the SALT program for MLU computation was 97% for the 3-year-olds' speech samples and 95% for the 4-year-olds' samples.

Results

The first question raised in this report concerned whether, overall, late talkers had more ear infections reported by parents before their second birthday. Data for answering this question are found in Table 2. There it can be seen that the normal talking group, as a whole, had an average of 4.6 ear infections reported by parents. The LT group had an average of 6.4. A *t*-test was performed on these data, and revealed that there was no significant difference ($t = 1.6$; $p < .10$) in the number of ear infections reported by parents for the two groups. The LT children, as a group, did not suffer a significantly higher number of ear infections than their peers with normal expressive language development.

Table 3 gives the mean scores and standard deviations for the subgroups on the expressive language and articulation measures used at ages 3 and 4. These results were subjected to analysis of variance, by means of the General Linear Model repeated measures ANOVA for between-subjects effects, using the SAS computer program. ANOVAs were done separately for the speech (Goldman-Fristoe and TOLD Word Articulation) and language (MLU) measures.

Results of the analysis of the MLU data, using diagnostic group and middle ear involvement as main effects, showed that there was a significant main effect for group ($F = 24.88$; $df = 1$; $p < .0001$). This indicated that, overall, the normal talking subjects had higher MLUs than the LTs. There was no significant main effect of middle ear involvement ($F = 0.27$; $df = 1$; $p < .60$), nor was there an interaction of group \times middle ear involvement ($F = 0.31$; $df = 1$; $p < .58$). These results suggested that, overall, middle ear involvement was not

associated with outcome in terms of MLU for either the normal talking or LT group.

The ANOVA for language was also done using time as a main effect. Here there was a significant main effect for time ($F = 30.89$; $df = 1$; $p < .0001$), suggesting that the MLUs of all subjects increased from age 3 to age 4. There was a significant group \times time interaction ($F = 7.47$; $df = 1$; $p < .01$). The source of this interaction effect can be discovered by examining the data in Table 3. Here it can be seen that the difference between the normal talking and LT groups was nearly three times as large at age 3 (when the normal talking group's mean MLU was 4.12, and the LT's was 2.51, with a gap of 1.61) as it was at age 4 (when the normal talking group's mean MLU was 4.63 vs. 3.99 for the LTs, with a gap of 0.64). This finding implies that the LTs are "catching up" with peers in terms of expressive language between ages 3 and 4. There were no significant interactions of time \times middle ear involvement ($F = 0.36$; $df = 1$; $p < .55$), or of time \times group \times middle ear involvement ($F = 0.16$; $df = 1$; $p < .69$). Again the findings suggest that middle ear involvement had no effect on expressive language outcome for either group at either age 3 or age 4.

The results of the articulation measures were also subjected to analysis of variance, using the same model. Here again we saw a significant overall effect of group ($F = 25.78$; $df = 1$; $p < .0001$), but no significant effect of middle ear involvement ($F = 0.54$; $df = 1$; $p < .47$). There was no significant interaction of group \times middle ear involvement ($F = 0.39$; $df = 1$; $p < .54$). These findings suggest once more that the normal talking subjects score higher on articulation tests and that middle ear involvement does not affect these results for either the normal talking or LT subjects.

The ANOVA on the articulation scores with time entered as a main effect revealed that there was no main effect for time ($F = 0.29$; $df = 1$; $p < .59$). This finding was due to the articulation scores' being percentile data; the subjects stayed at the same percentile level, as would be expected, from year to year. There was a significant time \times group interaction ($F = 3.87$; $df = 1$; $p < .05$), but no significant interaction of time \times middle ear involvement ($F = 0.00$; $df = 1$; $p < .98$) or time \times group \times middle ear involvement ($F = 0.96$; $df = 1$; $p < .33$). These findings suggest that, again, the gap between the normal talking and LT groups is closing over time. The

TABLE 4. Results of planned comparisons of scores of normal talkers (NT) and late talking (LT) children with positive (Hx+) and negative (Hx-) history of middle ear involvement.

| Group Difference | Age 3 | | Age 4 | |
|-------------------|--------------|----------------------|------------|-----------------------------|
| | MLU | Goldman-Fristoe %ile | MLU | TOLD Word Articulation %ile |
| LT Hx- vs. NT Hx- | $t = 4.26^*$ | $t = 3.94^*$ | $t = 1.60$ | $t = 1.65$ |
| LT Hx+ vs. NT Hx+ | $t = 3.71^*$ | $t = 4.59^*$ | $t = 1.93$ | $t = 3.92^*$ |

*significant at $p < .01$

normal talking group's mean percentile articulation score at age 3 was 61.5, whereas that of the LTs was 15.5. By age 4, though, the mean for normal talking was 55.5, whereas the LTs' mean percentile score had increased to 24.9. The lack of significant interaction effects of middle ear involvement suggests, again, that there was little effect of this history on articulation development overall.

Although these omnibus tests did not identify any significant effects of middle ear involvement for either expressive language or articulation, we were interested in exploring further to see whether effects could be found within specific cells in the data. For this purpose, planned comparisons using a t statistic at the .01 level of significance were employed. Specifically, we were interested in looking at how children with the same level of middle ear involvement in each of the diagnostic groups compared. That is, we wanted to know whether there were any differences between normal talking and LT children in the Hx+ subgroups and whether there were differences between normal talkers and LTs in the Hx- subgroups. These comparisons might give a more sensitive contrast than the omnibus tests were able to show. The results of these comparisons are given in Table 4.

Looking at the 3-year-olds' data, the results of the planned comparisons showed that the normally talking subjects in both the Hx+ and Hx- groups scored significantly higher in both expressive language and articulation than their LT counterparts. This confirms the findings of the omnibus test that the normal talkers score significantly higher, without regard to history of middle ear involvement. At age 4, however, there was no difference in either comparison on the expressive language measure. This finding is consistent with the significant interaction effect of the omnibus test, which suggested that the gap in MLU was closing with age, regardless of history of middle ear involvement.

At age 3, results of comparisons of scores on the articulation test again showed that both the Hx+ and Hx- normal talkers had higher scores than their LT counterparts, as the omnibus test suggested. But at age 4, the planned comparisons of the articulation scores yielded somewhat different results. Here there was no significant difference between normal talkers and LTs without a history of middle ear involvement, but there was a difference between the groups with a positive history. In other words, LT children without a history of middle ear involvement were following the path suggested by the significant interaction effect of group \times time

on the omnibus test. They were closing the gap between their scores and those of counterparts with a normal language history. But the LT children with a positive history of middle ear involvement were not closing the gap as quickly and still scored significantly lower in articulation than their peers with normal language history. This finding suggests that history of middle ear involvement may have some effect on the development of articulatory skills for children who are late talkers as toddlers. Roberts et al. (1988) have also suggested that use of phonological processes may be suppressed more slowly after age 4 in children with a history of otitis media.

Earlier studies of effects of otitis media have suggested that socioeconomic status and gender may interact with middle ear involvement to affect speech and language outcomes (Feagans, Blood, & Tubman, 1988). Although our study did not address these questions directly, we did examine whether there were any differences between groups in terms of SES or sex ratios. Analysis of variance revealed no overall group differences in terms of SES between normal talking and LT groups ($F = 2.81$; $df = 1$; $p < .10$). There was no significant difference between normal Hx+ and Hx- groups ($F = 1.17$; $df = 1$; $p < .29$) or between LT Hx+ and Hx- ($F = 0.98$; $df = 1$; $p < .33$). Fisher's exact tests were used to look at differences in sex ratios. A two-by-two table (middle ear involvement [\pm] by sex [M/F]) for the normal talking group showed no significant difference in sex distribution (one-tailed; $df = 1$; $p < .67$). The findings for the LT groups were analogous (one-tailed; $df = 1$; $p < .66$).

Discussion

For children developing language normally, this study, like that of Roberts et al. (1991), finds no evidence of increased risk for speech or expressive language delay that can be attributed to chronic middle ear involvement suffered during the first 3 years of life. This suggests that decisions about treatment for chronic otitis media in young children with normally developing language should be made on the basis of general health considerations and not as a necessity for preventing language delay.

Children who are late to develop expressive language are at a risk for prolonged slow language growth, at least until age 3, according to the results of this study, whether they have a history of frequent middle ear involvement or not. But the risk for chronic expressive language delay does not appear to be increased significantly by history of middle ear involvement as reported by parents, according to the findings of this study. Most children who start out with slow expressive language development move close to the normal range, at least as measured by sentence length, by age 4. This maturation appears to occur whether the LT children had a history of frequent middle ear involvement as toddlers or not.

But LT children with a history of middle ear involvement before age 3 do seem to have a somewhat greater risk for prolonged difficulties with articulation. LT children with negative histories of middle ear involvement improved, as a group, from a percentile score of about 19 at age 3 to a score of about 32 at age 4. In contrast, LTs with middle ear involvement as toddlers showed less improvement over this

period (from the 12th percentile to the 18th). What may be happening is that differences between LT children with positive and negative histories are masked at the early age by the fact that they are *all* still doing relatively poorly in verbal skills. As the children with negative histories improve with maturation, the effects of the history of middle ear involvement on articulation become more pronounced. These findings are in accord with those of Roberts et al. (1988), who showed that low SES children with a history of otitis media used more phonological processes after age 4 than their peers without such a history. Roberts et al. (1988) also suggested that the difference may not have been apparent until after age 4 because until that time all the children were doing a lot of phonological simplification.

These results suggest, as Bishop and Edmundson (1986) speculate, that chronic middle ear involvement in young children may interact with other risk factors to produce long-term effects. This study indicates that slow expressive language development may have such an interaction with early history of middle ear involvement, and that the effects seen will be most prominent in the area of articulation. Shriberg and Smith (1983) speculate that inconsistent auditory input due to fluctuating hearing losses that accompany middle ear involvement may negatively affect the child's ability to establish underlying features for consonants in early syllable production. Delays in the stabilization of these features would, in turn, delay the acquisition of other features that normally build upon the earlier ones. These cascading delays may result in chronic articulation deficits, particularly in children like our LTs, who have less efficient linguistic processing systems to begin with. Expressive language, on the other hand, which receives inputs from many mental systems and can take advantage of cognitive and social as well as linguistic development, may be more buffered from long-term effects. Pragmatic strategies may help the child to make sense of and produce connected discourse, whereas accurate articulation may rely more fully on a stable auditory image of the target production. Thus the child may be able to compensate for early deficits in auditory input when acquiring sentence production skills in ways that are not available in the area of phonological production.

Another explanation might relate to findings of Gravel and Wallace (1992), who found that 4-year-olds with a history of otitis media required a more favorable signal to noise ratio to perform at 50% sentence intelligibility than did peers with no such history. Although the magnitude of the difference between groups was small (3dB), the findings suggest that one lasting effect of early middle ear involvement may be some decrement in auditory attention management, making it difficult for the child to "tune in and tune up" (Shriberg, 1987) or to focus in on the small auditory differences in speech sounds and use auditory and proprioceptive feedback to replicate them on his own speech.

Several cautions are in order when interpreting these data, though. First, we would reiterate Roberts et al.'s (1988) caveat that the differences found here may be statistically significant but may not have great clinical significance. The LTs with a history of middle ear involvement did score more poorly on articulation than peers with normal language history, but they still scored at the 18th percentile—broadly

within the normal range. Moreover, the effect is detected only in a pairwise comparison, not by an omnibus test. Taken together, these findings suggest that the magnitude of the effect of early middle ear involvement on speech development would appear to be relatively small, even in children like the LTs who are at some risk.

Second, we would caution that although the present data appear to show that the LT subjects with and without histories of middle ear involvement "caught up" with their peers in terms of expressive language and articulation by age 4, MLUs for all the LTs were still at the low end of the normal range (normal range for 48 months: 3.46–5.33, Miller, 1981). The ANOVA results showed that although the MLU gap between children in the normal talking and LT groups is smaller at 4 than it was at 3, the gap is still substantial. Further, it must be remembered that the values discussed here are averages. Some of our children with a history of LT (see Paul & Alford, in press) did fall below the normal range on this measure. It appears, then, that most children with a history of LT move close to the low end of the normal range of sentence structure production by the end of the preschool period. In terms of phonology, LT children without a history of middle ear involvement move from the low end of normal to the mid-range of normal by age 4, whereas those with a history of chronic ear infections remain at the low end of the normal range by age 4 in both articulation scores and MLU.

Whether this situation constitutes any risk for later language and literacy development is currently a matter of speculation. Some data (Paul, 1993) suggest that even though children with a history of late talking function at the low end of the normal range in oral language skills by the end of the preschool period, they show deficits in metalinguistic and narrative skills related to literacy acquisition. It would seem to us premature to conclude that children with and without a history of middle ear involvement are completely "out of the woods" simply because they have moved up to the low end of the normal range on some measures of basic oral language.

Our clinical suggestions on the basis of these data would include the recommendation that all toddlers who are late to begin speaking should be carefully monitored to ensure that language development is proceeding, regardless of whether they have a positive history of middle ear involvement. Further, language delays present in toddlers should not be automatically attributed to a history of middle ear involvement and will not necessarily respond to treatment of the chronic middle ear involvement alone. Even if prophylactic antibiotic treatment is initiated or myringotomy tubes are inserted, language progress should be followed closely.

For LT children without histories of middle ear involvement, it would appear that basic productive language and articulation deficits will tend to resolve themselves by the late preschool period, although some deficits in metalinguistic and narrative skills related to literacy acquisition may persist. We would argue that preventive intervention for narrative and preliteracy deficits would be justified for this population, even when basic oral language problems appear to be outgrown.

For those LTs who do have a history of chronic middle ear involvement, this study suggests articulation management would be especially beneficial. As we have argued elsewhere

(Paul & Laszlo, 1992), articulation intervention is an ideal setting for developing phonological and metalinguistic awareness. This can be achieved by focusing clients' attention on how words are made up of sounds, using contrastive drills to help children see how sounds can be manipulated in words, and generally bringing sounds and words to a higher level of awareness. This type of intervention would, we believe, be particularly useful in helping children overcome their phonological delays and, at the same time, in laying the basis for literacy acquisition. Data from other studies of this cohort (Paul, 1993) suggest that such an approach could have salutary effects on LT children's chance to succeed in school. Although we believe all LT children with phonological problems could benefit from such an approach, the justification for providing it to LTs with a history of middle ear involvement seems, according to the present results, especially compelling.

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Contact author: Rhea Paul, PhD, Department of Speech and Hearing Sciences, Portland State University, P.O. Box 751, Portland, OR 97207. E-mail: (Bitnet) HURP@PSUORVM

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