

Results
Impact of Recurrent Otitis Media on Phonological Development

An investigation by Petinou, Schwartz, Mody and Gravel (1999) examined the effect of OME on early speech production. The study grouped sixteen infants into an OME positive group (OME+) and OME negative group (OME-) and concluded that there were no apparent differences between the groups in regards to consonants produced per minute (rate of vocalizations). Dissimilarities were evident regarding place and manner of articulation with infants in the OME+ group producing more bilabial stops and those in the OME- group producing more alveolar stops and nasals. In addition, it was concluded that the OME+ group with poor hearing thresholds showed preference for bilabial stops and the children with better hearing thresholds displayed more diversity in their phonetic inventories (Petinou, Schwartz, Mody & Gravel, 1999).

The children in this study were of equal socioeconomic status and consisted of both boys and girls as well African Americans and Caucasians. The study controlled for the caregiver's language proficiency, the language spoken in the child's home environment, the language of the primary caregiver, the language spoken by the child's siblings as well as the language most often used in the child's preferred television programs. It was determined that the participants were full-term infants and did not have cognitive deficits, neurological problems or delayed language. The examiners were blind to the children's OME status, with the exception of one of the authors who grouped the sixteen infants.

OME status was determined by both tympanometry and pneumatic otoscopy during the first year of life. Each child's overall status was determined by the percentage of visits of which the child was bilaterally free of OME or positive for OME. The investigation determined hearing thresholds by the use of visual reinforcement audiometry. The thresholds of the infants designated OME+ ranged from 20 to 36 dB HL whereas the OME- infants had hearing thresholds ranging from 3 to 13 dB HL. The groups were composed of 8 children each and phonetic transcriptions from infants' recorded babbling samples at the ages of 10, 12 and 14 months were analyzed. The rate of vocal output, proportional occurrence of consonants for place of articulation, and proportional occurrence of consonants for manner of articulation were measured.

Several different ANOVAs were completed appropriately and included both within and between subject variables. Post Hoc analyses were completed to account for multiple comparisons as well as to examine the specific differences between groups. Although the study included a multivariate statistical approach, the inclusion of hearing thresholds as well as a well-controlled design, it was deficient in statistical power due to the small sample size and failed to include confidence intervals.

Paden, Novak and Beiter (1987) established that different measures or conditions, in combination, were predictors of phonologic inadequacy. The study concluded that postvocalic singleton obstruents, velars and liquids, along with elevated thresholds at 500 Hz and a history of early onset and late remission from OME, were the most significant variables in characterizing children with atypical

phonological development by 3 years of age (Paden, Novak & Bieter, 1987).

The participants of the study included 40 children between the ages of 18 and 35 months who were recruited from a department of otolaryngology where they were referred for tympanostomy and tube insertion. The children reflected a small sample of the general population, only including severe cases documented as persistent unilateral or bilateral OME of more than 3 months' duration or more than four episodes of OME over the preceding 6 months (Paden, Novak & Beiter, 1987). A reliable and consistent protocol was followed to assess each subject otologically, audiological and phonologically prior to their surgery. It must be noted that the participants of this investigation, except for four children, had undergone at least one tympanostomy and tube insertion procedure before phonologic adequacy scores were obtained, possibly affecting the speech outcomes.

The study did not involve the use of blinding and only controlled for parents' occupation and education. Data regarding the subjects' medical history relating strictly to OME was collected retrospectively and recorded. The study used a restricted speech sample of 20 pre-determined words for phonological analysis.

From the cohort of children with OME, the subjects were divided into 3 groups based on phonological ability. Appropriately, overall discriminant analysis was performed to examine the differences between two or more groups of subjects with respect to several variables. Eight of the sixteen variables considered in the analysis were identified as being important in discriminating the three groups. Further, four separate discriminate analyses were performed on classification (case history), parental occupational and educational levels, audiologic information as well as initial phonological inadequacy scores. Multiple regression was also used appropriately to identify if initial independent variables could predict phonological inadequacy for the two groups that did not have typical development by age 3 (Paden, Novak & Beiter, 1987). The interpretation of correlation coefficient was accurate; however, the investigation failed to report an estimate of power or effect size. The statistical protocol confirmed the importance of using data from multiple areas for identification of phonological delay in children who suffer from OME.

This study identified a number of factors related to phonological deficiency that had significant predictive value; however, the findings must be interpreted with caution as many confounding variables were not controlled for. Although the study did include the use of hearing thresholds as a variable for analysis, the thresholds were based on the pre-operative assessment and did not include thresholds when effusion was present.

Roberts, Burchinal, Koch, Footo and Henderson (1988) conducted a prospective study concluding that the number of days with OME before age 3 did not have negative implications on early phonological development, but rather

risk for poor school performance due to socioeconomic factors and consisted of primarily African American children. The children's health status was reviewed each weekday and OME detection was assessed by pneumatic otoscopy as well as tympanometry. The investigation assessed hearing in specific cases but hearing measurement was not a standard protocol of the study as children were classified into groups based on their duration of OME. Speech was assessed annually when children were between 2 ½ and 8 years using the Goldman Fristoe Test of Articulation as well as calculating the total number of consonants in error (CER) and total phonological processes (TPP) present in the conversational sample (Roberts et al., 1988).

Total days of OME was used as the variable for analyses. Spearman correlations were employed to determine if a relationship was present between ranks on Total OME, CER, TPP and five individual processes at any given age. The study concluded that there were no significant correlations at a younger age; however, it indicated a mild correlation between Total OME and median TPP in the 4 ½ to 8 year age category. Post hoc tests, used to correct for multiple comparisons and to further examine the observed linear association, confirmed that older children with a higher incidence of OME had an increased usage of phonological processes and there was an unexpected association between unilateral OME and total phonological processes (Roberts et al., 1988)

Statistically, due to multiple analyses, the data was susceptible to Type I errors, which affected the possibility of an accurate decision (Roberts et al., 1988). In addition, selection bias was evident as the sample consisted of disadvantaged children who were identified as at risk for school-related issues in later development. Due to the selection of participants, the many confounding variables present and the lack of blind raters, it was not unlikely that a statistical association was found in this investigation.

A study by Shriberg, Friel-Pattie, Flipsen and Brown (2000) considered hearing loss as the independent variable of study and investigated the risk for speech delay associated with early recurrent OME with and without hearing loss. The study indicated that children who experienced a 20 dB average hearing threshold from 12 to 18 months of age had a higher prevalence of a speech disorder.

The read al

the study had 0 to 58 weeks of middle ear involvement with the most involvement occurring between 6 and 24 months of age. Based on duration of OME, the subjects were assigned to either an OME+ or OME- group with these two groups comprising a total group of which all children from both studies belonged. In addition, an OME severity subgroup was established and children were delegated based on the severity of their OME.

The second sample consisted of 50 English speaking, Native American children followed at a tribal health clinic. The use of this second sample of Native American children had many implications as the tribe selected had a very high prevalence of OME and was considered socioeconomically disadvantaged. The protocol of group assignment was similar to group one, with the sample of children being classified as OME+ or OME-. As with the first sample of children, there were many variables that were not accounted for, including the following: birth weight, familial history of speech disorder and gestational age.

it could be argued that the selection of high-risk or disadvantaged participants placed children at an increased risk for inadequate phonological development due to the relationship of OM with other environmental variables and not the independent effect of OM. In addition, the restricted focus on particular ethnic, socioeconomic or other defined groups limited the applicability and generalization to the larger population of children with OM.

The majority of investigations used similar procedures for measurement of speech outcomes and reported acceptable inter-rater reliability measures. In most cases criterion-referenced methods known to the profession were used to measure phonological outcomes. Measures included assessments that indicated the children's repertoire of sounds, the number of consonants in error as well as the phonological processes being used by the children. It can be argued that the measurement of consonant errors at such a young age was not a reliable measurement due to the variability in each child's phonological development.

It was addressed in some of the studies, and can be assumed in others, that children were medically treated when OM was present. Treatment included the use of antibiotics as well as tympanostomy and tube insertions. It would be unethical not to treat children with OM; however, it is difficult to determine whether the medical treatment which diminished the effusion aided in the acquisition of