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Prevalence of mild hearing loss in school-age children enrolled in special education

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special education**

Denney, Susan B., M.S.

San Jose State University, 1991

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PREVALENCE OF MILD HEARING LOSS IN SCHOOL-AGE CHILDREN
ENROLLED IN SPECIAL EDUCATION

A Thesis

Presented to

The Faculty of the Department of Nursing
San Jose State University

In Partial Fulfillment
of the Requirements for the Degree
Master of Science

By

Susan B. Denney

May, 1991

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ABSTRACT

PREVALENCE OF MILD HEARING LOSS IN SCHOOL-AGE CHILDREN ENROLLED IN SPECIAL EDUCATION

by Susan B. Denney

The purpose of this study was to compare the prevalence of referable hearing losses identified at school hearing screenings in two groups of students. One group ($n = 1089$) consisted of second and fifth grade students enrolled in regular classrooms, and the other group ($n = 95$) consisted of second and fifth grade students enrolled in Special Education not more than 50% of the day. Data were obtained from school health records and cumulative educational files. Chi-square tests were used to compare Special Education enrollment and hearing screening results. Results varied according to age group examined. The results from the second grade sample revealed that the second grade students in Special Education were more likely to have a hearing loss than the second grade students in regular education [$\chi^2(1, n = 615) = 4.62, p < .05$]. However, similar statistical analysis demonstrated no significance for either the fifth grade students ($n = 569$) or the total population ($N = 1184$).

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Chapter 1

INTRODUCTION

Hearing screening has been an important part of school health evaluations for many years and is presently the most frequently mandated school health screening in the United States with 61% of the states requiring hearing screening at public schools (Zanga & Oda, 1987.) Puretone acoustic audiometry is generally the accepted method for testing.

Hearing loss in school-age children can have far-reaching effects both educationally and socially. The two areas of development most affected are language and educational achievement (Menyuk, 1980). It is accepted that severe hearing disorders affect language and cognitive development (Lenich, Bernstein, & Nevitt, 1987), but the effects of mild hearing loss are not as clearly defined or recognized. The occurrence of otitis media with effusion (OME) or chronic otitis media is the most common cause of mild hearing loss and is also one of the most prevalent diseases in childhood (Northern & Downs, 1984, chap. 1). According to Downs (1983), more than 30 studies covering approximately 3500 children agreed that a relationship exists between early fluctuating hearing losses and later decreased learning skills. This research, however, has been severely criticized for its numerous limitations in design (Ventry, 1980). Several studies have shown no effect on

speech or cognition from OME (Kavanaugh, 1986). Yet as Ventry (1980) points out, "if a defined association between auditory processing disorders and chronic middle ear disease can be demonstrated in future research, a significant step in the prevention, detection, and therapeutic intervention of learning disabilities can be undertaken" (p. 116).

Background of Problem

According to Lenich, Bernstein, and Nevitt (1987), the hearing impaired make up the largest group of school-age handicapped persons in the United States. This same group of researchers estimate that more than 16% of all students in the United States have educationally significant hearing losses. The occurrence of OME or chronic otitis media is the most common cause of mild hearing loss and is also one of the most prevalent diseases in childhood (Northern & Downs, 1984, chap. 1). The occurrence of hearing loss parallels that of ear pathology. As pathologic conditions increase, hearing loss also increases. Occurrence of both otologic pathology and hearing loss is age-related in all studies of prevalence. Northern and Downs (1984, p. 3) report that otologic pathology peaks at age 2 with 30% abnormal ears and decreases to 15% abnormal ears by age 11.

Prevalence studies vary because of the cut off point considered as a loss; the time of year testing occurs, since ear pathology increases during the winter months; and the method of testing used (Northern & Downs, 1984, chap. 1).

Bess (1985) reported the incidence of hearing loss of 26-70dB HTL (decibels hearing threshold level) in 1.6% to 5% of children from his review of the literature. Roeser and Downs (1988, p. 62) found the referral rate from school settings averaged 5% to 10%, while their literature review reported 2.6% to 3.5% of children having a mild hearing loss.

During a workshop discussing the effect of otitis media on children (Bluestone et al., 1983), the physicians reported OME is less common in children after 7 years of age and that it clears spontaneously in most children within a few months. Marion Downs, a noted authority in audiology, reported in the same workshop (1983) that studies have found 75% of children with language problems by 5 years of age would be expected to still be language delayed at 9 years. Another member of the workshop (Bluestone et al., 1983), McWilliams, reported that articulation errors associated with fluctuating loss from otitis media tend to disappear with increasing age.

Some children do not make satisfactory progress in school despite consistent exposure to a variety of educational experiences. Some of these students are diagnosed as learning disabled (LD) and require individual educational assistance.

The etiology of learning disabilities is unclear. According to Sattler (1982), "some favor a neurologically based hypothesis, others a maturational hypothesis, and still others a motivational hypothesis" (p. 392). What is clear, however, is that when LD children are considered as a group, they exhibit inconsistent and inferior performances on academically related tasks. Learning disabled children may show deficits in such areas as auditory and visual memory, auditory sequencing, abstraction, conceptualization, and auditory and visual processing. It is only after a child has demonstrated marked academic failure that he or she is identified as learning disabled. In other words, the means of diagnosing learning disability occurs only after a child has entered and failed in school. According to the California Education Code (Santa Clara County Special Services, 1989), the criteria for diagnosis of learning disability requires that there must exist a severe discrepancy between individual ability and academic achievement. A school psychologist reports, "as educators have struggled to understand the problems of children who persistently achieve below their potential academic ability, relatively little research has been conducted to identify characteristics of LD in children prior to failure in the educational setting" (Rose, 1989, p. 4).

Purpose of Research

Mild or unilateral hearing losses have been found to affect speech and language development, cognitive learning, and social development. Criticism of methodology used in studies supporting these findings has decreased their validity and significance in recent years. All school-age children in California are screened for hearing loss with puretone audiometry under the direction of a school nurse or audiologist according to the California Administrative Code of 1986. Those students failing the initial screening are given individual threshold tests immediately following the screening test and at an interval of at least two weeks for those who fail the first threshold test. Students failing the retesting are referred for further medical or audiological evaluation and treatment.

Special education in the regular classroom includes resource or speech/language services for less than half the school day in order to assist functioning in the regular school program. Rose (1989) found little research that identified characteristics of LD children prior to failure in the educational setting. There is a need to identify factors associated with special education needs to better prevent, identify, and treat students with learning disabilities. Ventry (1980) said "if a defined association between auditory processing disorders and chronic middle ear disease can be demonstrated in future research, a

significant step in the prevention, detection, and therapeutic intervention of learning disabilities can be undertaken" (p. 116).

The purpose of this research study was to compare the prevalence of referable hearing losses identified at school hearing screenings in two groups of students. One group consisted of students enrolled in regular classrooms and the other group consisted of students enrolled in Special Education not more than 50% of the day. The research question was: What is the prevalence of mild hearing loss in school-age children enrolled in Special Education compared with the prevalence of mild hearing loss in children enrolled in regular education?

Hypothesis

The hypothesis tested stated that the prevalence of mild hearing loss in children enrolled in Special Education for part of the school day is greater than the prevalence of mild hearing loss in children in regular classrooms.

Definition of Terms

The following terms are defined for the purpose of this study:

1. Otitis media (OM) is an inflammation of the middle ear which may or may not be infectious (Bluestone et al., 1983).

2. Chronic otitis media is an inflammation of the middle ear that persists beyond 3 months (Bluestone et al., 1983).

3. Otitis media with effusion (OME) is an inflammation of the middle ear in which a collection of liquid is present in the middle ear cavity and mobility of the tympanic membrane is decreased. Hearing loss is present and may persist after an infection is cleared (Bluestone et al., 1983).

4. Puretone Audiometry is a technique of measuring hearing. A series of single frequency sounds or pitches, without accompanying overtones, are made at different decibels or degrees of loudness to determine level or threshold of hearing (Department of Health Services, 1989).

5. Threshold of hearing is the intensity of a stimulus that will just barely produce a sensation. In puretone audiometry, the threshold is defined as the minimal hearing level at which an individual is able to respond to a tone at least 50% of the time (Department of Health Services, 1989).

6. Conductive hearing loss is defined as a hearing loss originating in the external or middle ear while the inner ear and nerve are normal (Department of Health Services, 1989).

7. Special Education is additional help given to individuals or small groups of children when regular

instruction cannot be modified to meet a child's needs for learning (Santa Clara County Special Education, 1989).

8. Language Disorder is one category of special education service. According to Santa Clara County Special Education guidelines, "a pupil has an expressive or receptive language disorder when he or she scores at least 1.5 standard deviations below the mean, or below the seventh percentile of his or her chronological age or developmental age in one or more of the following areas of language development and morphology, syntax, semantics, or pragmatics" (Santa Clara County Special Education, 1989, p. 4).

9. Learning Disability (LD) is also a category of special education services defined by Santa Clara County Special Education guidelines: "a pupil has a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, which may manifest itself in an impaired ability to listen, think, speak, write, spell, or do mathematical calculations, and has a severe discrepancy between intellectual ability and achievement in one or more of the academic areas" (1989, p. 4).

Research Design

This study used a retrospective, cross-sectional, non-experimental design. Health records of all second and fifth grade students in one school district were examined

for puretone audiometric screening results in the 1989-90 school year. Lists were obtained from the Special Education Department to identify those students in regular classrooms receiving special education services for no more than 50% of the school day. Hearing screening failures or referrals were compared with special education enrollment to determine prevalence of hearing loss.

Initial approval for this research project was obtained from the school district in April, 1990 (Appendix C). The coordinator of Health Services, Special Projects and Special Services gave written approval to gather the needed information. Approval was obtained in May, 1990, from San Jose State University Human Subjects Institutional Review Board (Appendix D) and collection of data was accomplished during June, 1990. Confidentiality was strictly maintained. Data were recorded in such a manner that subjects could not be identified or linked to the data. Records were reviewed at the school sites and no one had access to the records except the researcher and authorized school personnel. No written informed consent was used because the research was performed with existing data held by the school district.

Scope and Limitations

The results did not establish a true cause and effect relationship because of the non-experimental design. Also randomization in the sampling procedure was not possible.

LoBiondo-Wood and Haber (1986) list the following as disadvantages of correlational studies such as this study:

(a) variables can not be controlled or manipulated, (b) randomization is limited because of dealing with preexisting groups, and (c) a causal relationship can not be established because of the lack of manipulation, control, and randomization (LoBiondo-Wood & Haber, 1986, p. 132).

The sample size was a limitation because of the number of students with hearing loss identified in the entire sample population, but the entire number of students included in the study was more than adequate. Another limitation was variation in weather at the time of audiometric testing. The amount of illness in school increases in winter months and incidence of hearing loss has been found to be greater during winter months (Northern & Downs, 1984, p. 56). Date of testing was noted in data collection. The majority of the initial screening was completed in October, but some students in year-round schools were tested in August or January. Also students absent during contracted screenings were tested at other times.

Chapter 2

CONCEPTUAL FRAMEWORK AND REVIEW OF LITERATURE

This chapter presents the conceptual framework and review of literature. The first section presents the conceptual framework of Piaget's learning theory. The second section presents the review of literature.

Conceptual Framework

The conceptual framework for this study is based on Jean Piaget's theory of intellectual or cognitive development. Piaget's theory is centered on cognitive development or mental processes such as perceiving, remembering, and reasoning. "Piaget defines intelligence as an individual's ability to cope with the changing world through continuous organization and reorganization of experience" (Singer & Revenson, 1978, p. 11). Cognitive development is cumulative; understanding of a new experience grows out of what was learned during a previous one. According to Piaget, adaptation is the most important principle of human functioning. Adaptation is the continuous process of using the environment to learn, and learning to adjust to changes in the environment. Adaptation takes place through assimilation and accommodation. Assimilation is the process of taking in new information and fitting it into a preconceived notion about objects of the world. Accommodation is adjusting to new

experiences by revising the old plan to fit the new information (Singer & Revenson, 1978).

Menyuk (1980) used Piaget's learning theory to postulate that in order to develop oral language, it is necessary for the child to learn to categorize the speech signals into language classes. These classes can then be used to process and perceive input that is new. If a child experiences fluctuating hearing loss as in otitis media with effusion (OME), the child may have difficulty in classifying the speech signals appropriately.

Piaget first discussed language and thought of children in 1926. Piaget's theory supports the idea that thinking begins before language and goes beyond language. He postulated that by the age of 7, a child's use of language changes to become an exchange of information for giving and receiving ideas and opinions. Piaget believes that as the structures of thought become more refined, more language is necessary for the achievement of this expansion (Singer & Revenson, 1978).

Piaget has defined certain stages each child goes through for cognitive development (Furth, 1969, p. 30). The child age 7 through 11 is in the concrete operations stage. The stage of concrete operations begins when the child is able to perform mental operations or categorizations. The child in concrete operations is able to think about actions and objects that are concrete and classify them in order for

learning to occur. As the child matures, he enters into the formal operations stage which requires understanding of hypotheses and propositions or the capacity to theorize about possibilities and hypothetical meaning and interrelations of several hypotheses (Furth, 1969, p. 31). Language is necessary to be able to pay attention to these theoretical positions and to communicate them to others. The children in this study were mainly in the concrete operations stage and were beginning to progress into formal operations. Therefore, it can be surmised that interruptions in language and the ability to hear would affect learning in the classroom. As with other disabilities, many children are able to adapt and compensate for the hearing loss. According to Roeser and Downs (1988), when referring to hearing loss, "only the rare child,--one with unusually high intellectual abilities--can surmount this learning hazard without being affected in some way" (p. 53).

Review of Literature

Although many studies have been done on the effects of hearing loss, research continues because results are inconclusive. Most available studies are directed towards effects from otitis media rather than actual documented hearing losses. Since otitis media is the most common cause of hearing loss in children (Roeser & Downs, 1988), these studies were also included in the literature review. One of

the earliest accepted studies was done in 1969 by Holm and Kunze in which a group of children 5 to 9 years of age with a history of OM and fluctuating hearing loss was found to be delayed in language perception and production.

Kaplan, Falshman, Bender, Baun, and Clark, (1973) completed a 10-year study of 489 Alaskan Eskimo children with a history of middle ear disease. Medical records were reviewed and parents were interviewed for the child's history of OM. Psychological testing was done. Otoscopic examination was performed on all children and audiological exams were completed with portable audiometers. Testing facilities used were quiet rooms in the schoolhouse. Achievement test results were obtained from school records. All children in the study were found to have school achievement deficits. The severity and age of onset of OM significantly correlated with the degree of later language and learning deficiencies. They found 16% of the children had extensive middle ear disease beginning at an early age and continued hearing loss of more than 25dB HTL. These children had the most profound drop in achievement scores, especially those measuring verbal ability. In the children with a hearing acuity of 26dB HTL or greater, 56% were behind their expected grade compared to 29% of those without loss. The gap between expected performance for grade level and demonstrated achievement scores was greater with older children in fifth and sixth grades.

Master and Marsh (1978) found a greater incidence of middle ear disease in learning disabled children. Their findings indicated twice as many children with middle ear pathology in the learning disabled group as the normal student group. Freeman and Parkins (1979) examined 82 children ranging in ages from 6 to 14 years for ear pathology. From the 82 children, 50 children were identified as learning disabled (LD) by the special education departments of their school districts. The remaining 32 were in normal regular education programs. Each child in Freeman and Parkin's study was tested by (a) otologic exam, (b) pneumatic otoscopy to assess tympanic membrane mobility, (c) pure-tone audiometry, and (d) impedance audiometry. The results were significant with all methods of testing. A total of 25% of the LD group failed puretone audiometry at 25dB HTL while 3% of the normal children failed; 24% had abnormal tympanometry as compared to 8% in the normal group, and 20% of LD children had abnormal otological exams versus 10% in the normal group.

One extensive literature review by a noted authority on audiology (Downs, 1983) found that 30 studies of 3500 children agreed that a relationship exists between early fluctuating hearing loss and later decreased learning skills. Several of those studies have been included in this literature review. Menyuk (1980) found that at 7 years of

age, children with four or more episodes of OM as an infant had significant speech and language difficulties, most of which were in speech production.

To determine the association between time spent with middle ear infection and development of speech and language, 205 three-year-old children were studied (Teele, Klein, Rosner, & The Greater Boston Otitis Media Study Group, 1984). Each child was followed prospectively from birth to record the number of episodes of middle ear disease and to document time spent with middle ear pathology. Children who had spent prolonged periods of time with middle ear disease had significantly lower scores than those who had little time with middle ear pathology. Time spent with OME in the first 6 to 12 months of life was not strongly associated with poor scores.

Sak and Ruben (1981) used a sibling control paradigm in which 18 children had a documented history of recurrent OME below 5 years of age, and the other 18 siblings did not. The effects of hearing loss on language learning due to recurrent middle ear effusions were examined. Paired comparisons of siblings' data revealed that the effusion subjects had deficits in verbal ability, auditory decoding, and spelling skills when compared with their control siblings.

Some studies of early OME did not show any correlation with language or cognitive development. Language was

years (Fischler, Todd, & Feldman, 1985). All subjects were examined with otoscopy, tympanometry, puretone audiometry, and a battery of language measures. No differences were found on language performance in groups with frequent OM and those with infrequent OM. Bilateral hearing loss ($> 25\text{dB}$ HTL) was observed in only 1% of the children in the study. All children had been followed from birth, and ear pathologies were well-documented.

Roberts et al. (1986) also examined the relationship between the occurrence of OME during the first 3 years of life and subsequent verbal and academic performance. A group of 61 socioeconomically disadvantaged children who attended a research day-care program were medically followed from birth to age 3 for OM and OME. Standardized tests of intelligence and academic performance were administered to the children when they were 3 1/2 to 6 years of age. All children were screened in kindergarten and none were found to have hearing loss. No evidence of associations between measures of early childhood otitis media and measures of verbal or academic functioning was found in this study population. Since both studies (Fischler et al., 1985; Roberts et al., 1986) followed the children medically for OM and hearing loss from birth, the results may have been due to improved treatment the children received to prevent significant hearing loss.

The relationship between minimal hearing loss (15-30dB HTL) and academic/intellectual functioning on a group of 552 fourth, fifth, and sixth grade students was investigated by two research psychologists (Burgener & Mouw, 1982). Three types of data were gathered for analysis: audiometric, academic, and intellectual. It was found that even hearing thresholds of 15dB HTL correlated with lower academic/intellectual functioning. The authors (Burgener & Mouw, 1982) concluded:

- (a) normal hearing does not predict good academic performance, but minimal hearing loss is related to poor performance, (b) minimal hearing loss is related to lower scores on group I.Q. measures, and (c)
- learning disabled students with a minimal hearing loss have a significantly lower verbal performance and full scale I.Q. scores than do their normal hearing counterparts. (p.7)

The results of Burgener and Mouw's findings were significant in suggesting that even lower levels of hearing thresholds correlated positively with intellectual function.

There was a high correlation between chronic OM and learning problems in a group of learning disabled (LD) children studied by Bennett, Ruuska, and Sherman (1980). Past and current middle ear status in 53 LD children was compared to past and current middle ear status in 56 control children without learning problems. Twenty-three percent of

the LD group had a history of recurrent OM compared to only 9% of the control group. At the time of the testing, 38% of the LD children and 16% of the control group had hearing abnormalities. It was found that 49% of LD children and 21% of the control group had abnormal tympanometry. It was clearly demonstrated by Bennett, Ruuska, and Sherman (1980) that LD children had significantly more middle ear malfunctions than the group of control children in their study.

The effect of unilateral versus bilateral hearing losses has also been studied. The medical and educational status of 75 children with unilateral sensorineural hearing losses of 45dB HTL or greater was examined by Bess (1985). Sensorineural hearing loss is usually permanent and involves pathology in the inner ear or the auditory nerve (Department of Health Services, 1989). It was found that 50% of the children with unilateral hearing loss had either failed a grade or were in need of resource assistance in the schools (Bess, 1985). A review of the literature by Bess demonstrated that "children with unilateral hearing loss experience far greater difficulty with communication and/or educational progress than was previously supposed" (p. 43).

Summary

Many studies have been done on the relationship of hearing loss and language and cognitive skills. No cause and effect relationship has been or can be shown and

opinions vary as to the significance of the studies completed. A workshop on the effects of OM on the child was attended by many of the authors cited thus far (Bluestone et al., 1983). Opinions varied greatly, but the conclusion of the conference attendees was "no convincing evidence exists at present to relate developmental impairments to single or to mild hearing loss irrespective of duration" (Bluestone et al., 1983, p. 650).

Ira M. Ventry (1980) criticized published research on the relationship between conductive hearing loss and language and learning impairment, saying "that the relationship has been poorly documented, that methodological flaws have contaminated the data and confounded the reported results, and that there is a continuing need for ongoing research in this area" (p. 143). This same author (Ventry, 1980) also said that if a positive correlation between OME and learning disorders could be shown through research, changes could be made to prevent and treat learning disorders. Many researchers feel there is already enough evidence to initiate changes to prevent and treat some learning disorders. The National Institute of Child Health and Human Development (NICHD) held in 1985 discussed the same issues and concluded that the results are significant and that there is a great need for intervention programs until preventive measures are available for children with conductive hearing losses (Eimas & Kavanaugh, 1986).

Chapter 3

THE METHOD

The purpose of this research study was to compare the prevalence of referable hearing losses identified at school hearing screenings in two groups of students. One group consisted of students enrolled in regular classrooms and the other group consisted of students enrolled in Special Education not more than 50% of the day. The research question was: What is the prevalence of mild hearing loss in children enrolled in Special Education compared to the prevalence of mild hearing loss in children in regular education. The hypothesis tested stated that the prevalence of mild hearing loss in children enrolled in Special Education is greater than the prevalence of mild hearing loss in children in regular classrooms.

Research Design

This retrospective cross-sectional study had a non-experimental design. School health records of all second and fifth grade students in one school district were examined for puretone audiometric screening results in the 1989-90 school year. Lists were obtained from the Special Education Department to identify those students in regular classrooms receiving special education services for no more than half the school day. Hearing screening results were compared in regular and Special Education students.

Population

Students included in the study lived in a semi-rural community of 27,000 located to the south of San Francisco Bay in Northern California. The socio-economic level was mixed. Occupations included farmworkers, local business workers, and commuters. The population was approximately 50% Hispanic and was heavily involved in seasonal and/or temporary work in the agribusiness industry. According to the local realtors organization, the median selling price for a single family home was \$281,000 for February, 1990, and yet according to the 1980 U.S. Census, 29.4% of the household incomes in the community were below the poverty level. The school district identified 11% ($n = 955$) of the students in December, 1988, from families receiving Aid to Families with Dependent Children (AFDC). The number of students receiving free or reduced price lunch, another indicator of low income status, was 2,733 or 32% of the population of students (Arnold, 1989).

The public school district in the community served 8,450 students in eight elementary schools, one junior high, one high school and a continuation high school. The school-age population was split into 52% Hispanic and 46% Anglo-American. Approximately 6% of the students (and their families) had limited English proficiency (Arnold, 1989).

All second and fifth grade students in the district were included in the study (approximately 1,300 students or

15% of total enrollment). Those students without health records or not tested for hearing during the 1989-90 school year were not included in the study. There were 695 students or 8% of the total student body receiving special education services in the district with 92 in the second grade and 60 in the fifth grade. Students in special education for adaptive physical education only and those students in all-day special education classes were not included in the special education group.

Method of Data Collection

Public Law 94-142 (1975), the Federal Education for Handicapped Law, requires that health impairments affecting learning in the school be identified. All school-age children in California are screened for hearing loss with puretone audiometry under the direction of a school nurse or audiologist according to Section 2951, California Administrative Code, Title 17 (health code). A sweep-check screening test using puretone audiometry is first performed at the intensity level of 25dB HTL at the frequencies 1000, 2000, and 4000 hertz (Hz) in each ear by a registered audiometrist. Those children failing to hear any of these tones receive an individual threshold test immediately following the sweep screening test at 250, 500, 1000, 2000, and 4000 Hz (Department of Health Services, 1989). All students with hearing levels of 30dB HTL or greater for two or more frequencies, or 40dB HTL or greater for any one of

the frequencies are retested in no less than two weeks and referred, if the same criteria is met, for private medical-audiological examinations (Department of Health Services, 1989).

All second and fifth grade students were screened following state audiometric guidelines for hearing loss every year in the selected school district. The majority of the initial screenings and threshold tests for this district were completed by one school audiometrist on contract with the school district under the direction of a school nurse during October or November, 1989. A sound-resistant van, equipped with a Maico puretone audiometer, was used at each school site. Instructions were given before and during testing in each child's own language. Follow-up audiometric threshold testing for hearing screening "failures" and absences were completed by a school nurse with audiometrist certification. The audiometric testing, performed by five different nurses, was done using a portable audiometer in a quiet room with controlled ambient noise levels at each school site. Dates of testing varied at each school. For the purpose of this study, students referred for medical-audiological follow-up comprised the hearing loss group. No students with severe hearing losses enrolled in special education classes for the hearing-impaired were included in the study.

Special Education, according to Public Law 94-142 (1975), is special help given to individuals or small groups of children when regular instruction cannot be modified to meet a child's needs for learning (Santa Clara County Special Services, 1989). In order to qualify for special education, the child's intelligence and level of functioning in the classroom is considered. The child is placed in special day classes for the majority of the school day when educational testing reveals severe deficits in social and living skills, learning disorders, or severe speech and language disorders. Children with less severe forms of disabilities are served in special education programs less than half the school day. Resource and speech/language services are the two main programs used for children with less severe disabilities. Resource serves children with exceptional needs who require special education for less than half the school day in order to assist their functioning in the regular school program. Speech and language services are provided for those children who demonstrate difficulty understanding or using spoken language to such an extent that educational performance is affected and the difficulty can not be corrected without Special Education (Santa Clara County Special Services, 1989). For this study, the Special Education group is limited to those students in resource or speech/language programs.

Procedures

The purpose of this study was to compare the prevalence of referable hearing losses identified at school hearing screenings in two groups of students. One group consisted of students enrolled in regular classrooms. The other group consisted of students enrolled in Special Education not more than 50% of the day.

Health records were examined for hearing losses. Information regarding Special Education placement was obtained from cumulative education files. Two data collection forms were used. Data Collection Form #1 (Appendix A) was used to identify children with hearing losses. Information gathered included grade, sex, date of audiometric screening and Special Education enrollment. Data Collection Form #2 (Appendix B) was used to gather specific information on the individuals with losses, including degree of hearing loss, age of child and language spoken at home.

The rights and welfare of individuals included in this study were carefully protected. Confidentiality was strictly maintained. Data were recorded in such a manner that subjects could not be identified or linked to data. Records were reviewed at the school sites and no one had access to the records except the researcher and authorized school personnel. Permission was obtained from the school district to audit the school records (Appendix C). San Jose

State University Institutional Review Board-Human Subjects also gave approval for the project (Appendix D).

Data Analysis

The purpose of this study was to compare the prevalence of referable hearing losses in two groups of students. One group consisted of students enrolled in regular classrooms. The other group consisted of students enrolled in Special Education programs less than 50% of the day. The hypothesis tested stated that the prevalence of mild hearing loss in children enrolled in Special Education for part of the school day is greater than the prevalence of mild hearing loss in children in regular classrooms. The chi-square test (χ^2) was used to analyze data regarding hearing loss in the two groups of students. Point-biserial correlation (r_{pb}) was used to test the significance of the level of hearing in the hearing loss group. Analysis of grade, sex, Special Education enrollment, and types of loss was accomplished by applying chi-square (χ^2), and Fisher Exact Probability testing.

Chapter 4

RESULTS AND DATA ANALYSIS

This chapter describes the data collected and procedures used to analyze the data. The purpose of this study was to compare the prevalence of referable hearing losses identified at school hearing screenings in two groups of students. One group consisted of students enrolled in regular classrooms. The other group consisted of students enrolled in Special Education not more than 50% of the day. Data were collected from school health records and cumulative education files at eight elementary schools in one school district. Two data collection forms were developed and used by the researcher to gather the retrospective data. Form #1 (Appendix A) was used for all the records reviewed ($N = 1184$) and Form #2 (Appendix B) was used for those students who failed the hearing screening completed during 1989-90 ($n = 18$). Statistical analysis performed on the data included point-biserial correlation (r_{pb}) and the non-parametric measurements of chi-square (χ^2) and Fisher Exact Probability testing.

Sample

The sample included 569 fifth grade students and 615 second grade students for a total of 1184 students. Students were divided into two groups according to Special Education enrollment (Table 1). Although the second grade

Table 1

Distribution of Sample by Special Education Enrollment
(N = 1184)

Grade	(n)	Special Education	Regular Education	% Special Education
2	615	64	551	10.4%
5	569	31	538	5.4%
Total	1184	95	1089	8.0%

and fifth grade samples were equal in size, the per cent of students enrolled in Special Education in second grade (10.4%) was nearly double the per cent of students enrolled in Special Education in fifth grade (5.4%).

Table 2 shows the sex distribution in the two separate subgroups. The sex distribution in the regular education group was nearly equal. The larger number of males in the Special Education group was consistent with Special Education throughout the nation (Rose, 1989). Because of the small sample numbers, both types of Special Education, speech and resource, were considered as one group, and analysis of speech versus resource was not attempted.

Screening dates varied according to school attended and individual absences, but the majority of students were tested during the winter months of October through January. The screening dates of the hearing loss group were similarly distributed over the same months.

Results and Data Analysis

The puretone audiometric screening results of the entire group ($N = 1184$) and the two subgroups, regular education ($n = 1089$) and Special Education ($n = 95$) are presented according to grade level in Table 3. The screening results showed the prevalence of hearing loss in the second grade ($n = 12$) to be twice that found in the fifth grade ($n = 6$). This is consistent with the literature which reported hearing loss to be age-related in all studies

Table 2

Distribution of Sample According to Sex (N = 1184)

Grade	(n)	Male	Female
Regular Education (n = 1089)			
2	551	266	285
5	538	255	283
Special Education (n = 95)			
2	64	42	22
5	31	25	6

Table 3

Puretone Audiometric Screening Results

Grade	(n)	Passed	Failed	% Failed
Total Population (N = 1184)				
2	615	603	12	2.0%
5	569	563	6	1.1%
Total	1184	1166	18	1.5%
Regular Education (n = 1089)				
2	551	543	8	1.54%
5	538	532	6	1.12%
Total	1089	1075	14	1.28%
Special Education (n = 95)				
2	64	60	4	6.25%
5	31	31	0	0
Total	95	91	4	4.21%

of prevalence. Research found that ear pathology, and therefore hearing loss, peaks at age 2 and decreases by age 11 (Northern & Downs, 1984, p. 3). No fifth grade Special Education students failed the hearing testing.

Figure 1 shows the comparison of the percent of children failing audiometric screening according to grade and Special Education enrollment. The second grade Special Education group had a much higher percentage of failure (6.25%) than any other group of students. The total percent of Special Education students with hearing failures was 4.21%. The percent of regular education students with hearing failures was less than 2% for both grades.

According to Polit and Hungler (1983, p. 521), the chi-square probability is significant at 3.841 or above with degrees of freedom at 1 and p-value less than .05. Chi-square tests with degrees of freedom (df) at 1 and p-value less than .05 were used to compare Special Education enrollment and hearing results in the entire group ($\chi^2 = 3.02$), fifth grade only ($\chi^2 = 0.98$), and second grade only ($\chi^2 = 4.62$). The chi-square test on the second grade sample revealed that the students in the Special Education group in the second grade were more likely to have a hearing loss than those students in regular education. The fifth grade and the total sample results did not indicate that Special Education students were more likely to have a hearing loss.

Figure 1. Percent of Children Failing Puretone Audiometric Screening.

Results of data from the hearing loss group ($n = 18$) were further examined. The home language information was not complete in all of the health records, therefore, the information was not included in the results and data analysis. Bilateral and unilateral hearing losses were compared to grade, Special Education enrollment, and sex (Table 4). All three revealed no significant relationships to bilateral or unilateral hearing loss when tested by chi-square and Fisher's Exact Test, two measures used to test nominal data (LoBiondo-Wood & Haber, 1986, p. 245). The phi coefficient (ϕ), used to express the relationship found between variables measured at the nominal level (LoBiondo-Wood & Haber, 1986, p. 247), was insignificant. The degree of hearing loss or dB HTL was examined to determine any correlation of degree of loss with Special Education enrollment (Table 5). A test of Point-biserial Correlation ($r_{pb} = .18$) revealed no significant correlation between degree of loss and enrollment.

The percent of children in the hearing loss group found to be a grade behind according to age was much higher than the regular education population (Table 6). Data were not collected regarding age in the larger hearing group, therefore statistical comparisons were not made. However, according to district reports, the retention rate for elementary schools for this district was 1.8% for the year 1989/90 (B. Straub, personal communication, Oct. 3, 1990).

Table 4

Unilateral and Bilateral Hearing Loss Comparisons

Group	Unilateral Loss	Bilateral Loss
	<u>n</u>	<u>n</u>
Comparison by Sex		
Female	2	3
Male	7	6
[$\chi^2(1, n = 18) = 0, p < .05$; Fisher = .50, $\phi = .12$]		
Comparison by Enrollment		
Spec. Ed.	2	2
Reg. Ed.	7	7
[$\chi^2(1, n = 18) = .32, p < .05$; Fisher = .71, $\phi = 0$]		
Comparison by Grade		
Grade		
2	7	5
5	2	4
[$\chi^2(1, n = 18) = .25, p < .05$; Fisher = .31, $\phi = .24$]		

Table 5

Degree of Hearing Loss Compared to Special EducationEnrollment (n = 18)

Enrollment	30-40dB HTL	45-55dB HTL	60-70dB HTL
	<u>n</u>	<u>n</u>	<u>n</u>
Spec. Ed.	2	2	0
Reg. Ed.	5	5	4

Note. 25dB HTL or less = normal hearing.

Table 6

Hearing Loss Group Grade Repeaters According to Age (n = 18)

Grade	Age Appropriate	Repeaters	% Repeaters
	<u>n</u>	<u>n</u>	
2	5	7	58%
5	5	1	16.7%
Total	10	8	44%

More research would need to be completed to come to any significant conclusions regarding the need to repeat a grade among the hearing loss group.

Hypothesis and Results

Chi-square tests were used to test the hypothesis that the prevalence of mild hearing loss in children enrolled in Special Education part of the school day is greater than the prevalence of mild hearing loss in students in regular classrooms. Results varied according to age group examined. The fifth grade group had no children in the Special Education group with a hearing loss and did not support the hypothesis [$\chi^2(1, n = 569) = 0.98, p > .05$]. The entire group result showed a higher percentage of hearing loss in Special Education students than regular education, but chi-square results were not statistically significant [$\chi^2(1, N = 1184) = 3.02, p > .05$]. The chi-square test on the second grade group revealed that the students in the Special Education group in the second grade were more likely to have a hearing loss than those students in regular education in the second grade [$\chi^2(1, n = 615) = 4.62, p < .05$]. The hypothesis tested stated that the prevalence of mild hearing loss in children enrolled in Special Education for part of the school day is greater than the prevalence of mild hearing loss in children in regular classrooms. This analysis of data supports the hypothesis for second grade children but does not support the hypothesis for fifth grade children.

Chapter 5

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was to compare the prevalence of referable hearing losses identified at school hearing screenings in two groups of students. One group consisted of students enrolled in regular classrooms. The other group consisted of students enrolled in Special Education not more than 50% of the day. The literature generally accepts the fact that severe hearing disorders affect language and cognitive development. The question for this study was: What is the prevalence of mild hearing loss in school-age children enrolled in Special Education compared to the prevalence of mild hearing loss in children in regular education? The literature has shown varied results from past studies. This chapter presents the conclusions of this research study, recommendations for further research, and implication for the school nurse role.

Conclusions

The results of this study suggest that second grade students in Special Education are more likely to have a hearing loss than those students in regular education. Fifth grade students in Special Education did not have a higher prevalence of hearing loss. This may be due to the small sample of students with hearing loss from this age group. A larger sample would need to be examined to make

significant conclusions.

Descriptive data from the hearing loss sample indicate that unilateral and bilateral losses occur almost equally according to age or grade, sex, and Special Education enrollment. Students with unilateral hearing losses should not be ignored in the classroom setting, but should be treated as those with bilateral losses. No correlation of degree of hearing loss and Special Education enrollment was observed. This would indicate the importance of considering the effects of the mild hearing loss as well as moderate loss in the classroom.

The foremost purpose of any hearing screening program is to identify the children who have hearing impairment that interferes with their educational development. A student has to demonstrate marked academic failure before being enrolled in Special Education unless a diagnosis of severe hearing loss or some other disability has been made. This study indicated a higher prevalence of hearing loss in Special Education students in second grade than in regular education students. No true cause and effect can be stated, but possibly the failure required to enter Special Education could be prevented or treated if students with mild hearing loss received adequate treatment. This treatment must involve adequate medical treatment, as well as adaptations in the classroom and home to meet the needs of the child with a mild hearing loss.

A review of the literature revealed similar studies with small numbers of current hearing impairment, but none used data obtained from school hearing screenings. Larger numbers need to be studied to come to appropriate conclusions for the general population.

Recommendations for Further Research

The information obtained from conducting this study suggests the following recommendations for further research:

1. Replication of this study with a larger sample.
2. Replication of this study at other school districts to determine if the findings can be generalized to other settings.
3. A comparison of the prevalence of hearing loss and results of standardized test scores to further define the effect of hearing loss.
4. A comparison of the prevalence of hearing loss and the need to repeat a grade in school to further define the effect of hearing loss.
5. Descriptive studies of behavior and social skills of children with mild hearing loss.
6. Descriptive studies of adaptations made in schools to meet the needs of children with mild hearing loss.

Implication for School Nurse Role

The results of this study stress the need for improved school hearing conservation programs, especially for the younger grades. Although hearing screening in public

schools is required in 61% of the states (Zanga & Oda, 1987), more laws should be passed to mandate hearing screening in all states. School nurses should coordinate hearing screening and provide follow-up of those children with identified hearing losses. It is necessary for the nurse to be educated in current methods of identification, treatment and adaptation to provide adequate follow-up with parents, educators, and physicians of students with hearing loss.

Lenich et al. (1987) discussed a proposal for improved hearing conservation programs. They listed the following as services necessary to achieve this goal:

1. High-risk register and referral system
2. Comprehensive screening program
3. Ongoing audiologic evaluation
4. Management of amplification
5. Consultation on appropriate educational placement
6. Management of classroom acoustics (p. 345)

A comprehensive screening program should include testing the general school population at regular two or three year intervals and testing the Special Education population yearly. If a child has a fluctuating hearing loss, the child may have difficulties in the classroom, but still pass a yearly hearing screening. Teachers need to be made aware of this possibility and be encouraged to request hearing exams as needed throughout the school year for

individual students. Hearing losses identified at group screenings should be referred for medical treatment as soon as possible, and teachers should be made aware of the problem.

The school nurse should follow up on medical treatment and encourage adaptation of the classroom to meet the needs of the individual involved. The classroom adaptation may include any of the following: (a) seating near the front of the room with the better ear toward the teacher, (b) more rugs and acoustical features in the classroom, (c) small groupings with the instructor to decrease noise level, and (d) the use of a louder voice or a loudspeaker in the classroom. Educational adaptations could also include use of more visual methods of learning and a program to teach listening skills to children with hearing losses.

The parent should take an active role in adaptation needs and be made aware of available treatment and services. A school nurse may act as case manager for Individualized Educational Planning or as a consultant to teachers and parents to assure that adequate medical and/or audiological care for the child is obtained. The parent-teacher relationship is especially important to meet the educational needs of the child and to assure on-going awareness of changes in hearing status. The school nurse should facilitate good communication among parents, teachers, and medical or audiological caregivers.

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APPENDICES

APPENDIX A
Data Collection Form #1:
For Review of Existing Records

Data Collection Form #1
For Review of Existing Records

Page # _____
School _____

	Grade	Sex	Audiometric Screening		Spec. Ed.	
			Date	Results	Resource	Speech both
1.						
2.						
3.						
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APPENDIX B

Data Collection Form #2:

For Review of Records with Identified Hearing Losses

Data Collection Form #2

For Review of Record with Identified Hearing Losses

- 1) Page # _____ 2) Student # _____
- 3) Bilateral _____ Unilateral _____
- 4) Decibels in worst ear _____ Frequency _____
- 5) Sex _____ 6) Grade _____
- 7) Age _____ 8) Special Ed _____
- 9) Home language _____

APPENDIX C

Approval by Gilroy Unified School District

Gilroy Unified School District

KENNETH A. NOONAN, SUPERINTENDENT

Serving the Youth of Gilroy Since 1852

7810 ARROYO CIRCLE
GILROY, CALIFORNIA 95020
TELEPHONE (408) 847-2700

April 2, 1990

Susan Denney, PHN
7225 Trenton Pl.
Gilroy, CA 95020

Dear Mrs. Denney,

This letter is to give permission to Susan Denney to gather needed information for her Master Thesis for San Jose State University.

This permission is given to do research on the relationship of mild hearing loss identified by the school nurse and the need for special education.

Confidentiality must be maintained, and only group data may be compiled and reported.

Good luck and if I can be of any assistance please call on me.

Sincerely,

Marcia Arnold
Coordinator of Health Services

Terry Wenig, Coordinator Special Projects

Pat Pelz, Coordinator of Special Services

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APPENDIX D

Approval by Human Subjects

Institutional Review Board

Office of the Academic Vice President • Associate Academic Vice President • Graduate Studies and Research
One Washington Square • San Jose, California 95192-0025 • 408/924-2480

To: Susan B. Denny, Nursing
7225 Trenton Place
Gilroy, CA, 95020

From: Charles R. Bolz
Office of Graduate Studies and Research

Date: May 10, 1990

As required by University policy, the Human Subjects Institutional Review Board has reviewed your proposed project entitled:

"Mild Hearing Loss and Special Education"

Because your project is to be limited to the collection of existing data that cannot be identified with human subjects, your project is exempt from further review. Therefore, you may proceed without further review by the Human Subjects Institutional Review Board.

I, however, do caution you that whenever people participate in your research as human subjects, they should be appropriately protected from risk. This includes the protection of the anonymity of the subjects' identity with regard to any and all data that may be collected from the subjects. If at any time a subject becomes injured or complains of injury, you must notify Dr. Serena Stanford immediately. Injury includes but is not limited to bodily harm, psychological trauma and release of potentially damaging personal information.

Please also be advised when people participate in your research as human subjects, each subject needs to be fully informed and aware that their participation in your research project is voluntary, and that he or she may withdraw from the project at any time. Further, a subject's participation, refusal to participate or withdrawal will not affect any services the subject is receiving or will receive at the institution in which the research is being conducted.

If you have any questions, please contact Dr. Stanford or me at (408) 924-2480.

cc: Virginia Young, Ph.D.