EDUCATIONAL IMPLICATIONS OF RECURRENT OTITIS MEDIA AMONG CHILDREN AT RISK FOR LEARNING DISABILITIES

By

Frances Fein Loose

A DISSERTATION

Submitted to
Michigan State Universitc
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Counseling, Educational Psychology, and
Special Education

1984

ABSTRACT

EDUCATIONAL IMPLICATIONS OF RECURRENT OTITIS MEDIA AMONG CHILDREN AT RISK FOR LEARNING DISABILITIES

By

Frances Fein Loose

The purpose of this research was to determine incidence rates of recurrent otitis media among twenty-five learning disabled and twenty-five non-handicapped elementary school children, and to compare allergy incidence and patterns of school experience between the children with recurrent otitis history and those with minimal otitis history. Otitis media is middle ear inflammation manifested as an infection and/or significant negative pressure causing collection of fluid in the middle ear space.

Subjects' parents completed developmental histories and Fisher's Auditory Problems Checklists. General education teachers completed questionnaires concerning their knowledge of the children's medical history, their rating of the children's school performance and the frequency of parent contact with school. A count of school absences per year since kindergarten was obtained from school records. All children received diagnostic audiological evaluations measuring peripheral hearing, middle ear status, and central auditory processing. The learning disabled(LD) students completed self assessments of school performance. Special education teachers recorded the ages at which LD students were

first identified as handicapped, student scores on the Wechsler Intelligence Scale for Children-Revised(WISC-R), and ratings of student academic performance.

Both the learning disabled and non-handicapped children exceeded the normal incidence rate of otitis media reported in the literature. Often teachers were unaware of which students had recurrent otitis media. The LD and recurrent otitis groups had higher hearing thresholds at some frequencies, and they experienced more difficulty with some central auditory processing tasks. The otitis students had higher absenteeism rates.

The learning disabled children with recurrent otitis performed more poorly on some verbal subtests on the WISC-R, had higher than average incidence of allergy, and were reported as being weaker in oral expression than their peers. While there were marked differences between LD and non-handicapped students in attention to task and unusual activity levels, there was no significant difference between low and high incidence otitis LD students.

Frequency of parent contact with school did not differ significantly across groups, nor were there differences between the low and high incidence otitis LD groups on their self assessments.

ACKNOWLEDGEMENTS

The writer wishes to acknowledge and thank the following individuals for their time, support, and guidance in the completion of this study.

Norman Bell, Ph.D., Michigan State University, Counseling, Educational Psychology, and Special Education

Steven Carlson, Ph.D., Rutgers University, Educational Psychology and Special Education

Michael Chial, Ph.D., Michigan State University, Audiology and Speech Sciences

Richard Featherstone, Ph.D, Michigan State University, Administration and Curriculum

Rasem Ghannam, M.D., allergist

Charles Henley, Ph.D., Michigan State University, Counseling, Educational Psychology, and Special Education

Ruth Johnson, Toledo Public Schools, Project C.H.I.L.D.

William Kothman, Telex Communications, Inc.

John, Geoffrey, and Christopher Loose

James McLoughlin, Ph.D., University of Louisville, Special Education

David Sciamanna, D.O., Edward W. Sparrow Hospital, Neonatology and Developmental Medicine

May Shayne, A.C.S.W., Vanderbilt University

Catherine Stewart, Michigan State University, Audiology and Speech Sciences

Michael Stewart, Ph.D., Michigan State University, Audiology and Speech Sciences

Marilyn Willhoit, American ElectroMedics Corporation

Staff Members in the participating school districts and Parents and Children participating in the study

TABLE OF CONTENTS

LIST OF TABLES

INTRODUCTION

The purpose of this research was to determine the incidence rates of recurrent otitis media in learning disabled children and the relationship between otitis, allergy incidence and various aspects of the elementary school experience among learning disabled and non-handicapped children.

Problem

Otitis media is an inflammation of the middle ear which may be manifested as an infection (acute otitis media) and/or significant negative pressure causing collection of fluid in the middle ear space (serous otitis media). It is one of the most common health problems among young children. It often causes mild, fluctuating hearing loss, which some researchers believe may influence the development of language problems, behavior difficulties, and chronic medical problems if the otitis persists or reoccurs frequently. Children at risk for learning disabilities by virtue of heredity or medical history are often also medically at increased risk for recurrent otitis media. This would likely compound their already high risk for the language and behavior problems listed above.(Hanson 1979, Bierman 1980,Wiig 1976)

This dissertation is directed at the analysis of medical and developmental histories, current school performance

and audiological status of 25 learning disabled and 25 non-handicapped children with a focus on the incidence rates of otitis media and the differences in patterns of performance seen between those with and those without a recurrent pattern of otitis media.

For purpose of analysis, students are compared in two ways: learning disabled vs. non-handicapped (control) and low incidence vs. high incidence otitis media.

The length of this research project was limited to approximately one year, negating the possibility of a longitudinal study of a large number of high risk infants from birth through early elementary school. This required reliance on retrospective reports from parents about child development. Another point to consider is that relative to children currently in first and second grades, the high risk infants today typically receive markedly more sophisticated medical care during the mother's pregnancy, delivery, and during the neonatal period. Some of the factors which may affect the health of current school age children are likely to be different for the population entering school in five years.

A second time limitation of the study resulted from the fact that the audiologist and audiology clinic were only available during late spring on Saturdays and between 4:00 and 8:00 P.M. on weekdays. If testing could have been done during the winter months, probably more active otitis media would have been detected.

An advantage of the study occurring in spring was that teachers were as well acquainted with the children in the study as they were ever likely to be, and their responses to the questionnaires would be more reliable. Also, the fairly broad systems approach, contacting parents, children, audiologists, and school personnel, as well as records on file permit the results to be useful in planning follow-up research as well as school intervention strategies for the next academic year.

In addition to the time constraints in the study, the writer worked within a limited geographic area with volunteer students who had already been identified as learning disabled by a variety of multidisciplinary teams which may have applied different guidelines for eligibility.

Research Hypotheses

1. Incidence of serous and acute otitis media among learning disabled students is higher than in the non-handicapped population.

2. Among learning disabled students with recurrent otitis media, defined as at least six occurrences of otitis within two years, there is a higher than average incidence of reported allergy symptoms which may continue to affect school adversely after the otitis resolves.

3. Learning disabled children with recurrent otitis media exhibit greater verbal deficits relative to their non-verbal performance than do other learning disabled children.

4. More learning disabled children with recurrent otitis media experience difficulty attending to task than other learning disabled children.

5. A higher percentage of learning disabled children with history of recurrent otitis media experience abnormally high or low activity levels than their learning disabled peers.

6. Children with recurrent otitis media miss more school, hence more opportunity for instruction than most students.

7. Learning disabled children with a history of recurrent otitis are more likely to perceive an external locus of control for their school progress than are other learning disabled children of similar ages.

8. The majority of teachers working with young learning disabled children do not routinely consider the possibility of a history of otitis media contributing to the students' learning problems.

9. Parents of learning disabled children with a history of recurrent otitis are likely to perceive themselves or be perceived by school personnel as different in the frequency of their interaction with their child's teachers.

Definitions

allergy: unusual sensitivity to small amounts of foreign substances or to physical conditions, which cause no adverse reactions in most people, even when exposed to large amounts of that substance

conductive hearing loss: failure of the ear to transmit sound waves from the environment to the inner ear and then to the brain, usually 15-30dB, primarily a loss of loudness of some sounds

dB: decibel, unit of sound wave height or intensity. Average young adults 18-24 years perceive sounds at 0dB. Whispers register at about 30dB, conversation at 45-50dB, rock concerts at 100dB or more.

Hz: hertz, the unit of measurement of sound wave frequency, 1 cycle per second; <500Hz low-pitched, >2000Hz high-pitched, middle C 256Hz with each octave above doubling the frequency, and each octave below halving it. Humans can hear frequencies from 20-20,000Hz.(Batshaw, 1981, p.272)

impedance audiometry: test of middle ear function in which a probe placed in the ear canal creates an airtight seal. Then air is pumped in or removed so that the pressure ranges from -500 to +200 mm of water. When a sound is presented through the probe, a measurement of how it reflects off the eardrum at different pressures is recorded on a Tympanograph. Because of the flexibility of normal eardrums, a normal Tympanogram results in a bell-shaped curve.(Batshaw, 1981, p.280)

learning disability: See Specific Learning Disability

middle ear: area from the eardrum to the cochlea

myringotomy: minor surgical procedure in which an incision is made in the tympanic membrane, often accompanied by the insertion of ventilating tubes, which serves to equalize the pressure between the middle ear and the ear canal and enables fluid to drain(Batshaw, 1981, p.276)

otitis media: inflammation of the middle ear which may be manifested as an infection (acute otitis media) and/or significant negative pressure causing collection of fluid in the middle ear space (serous otitis media)

otolaryngologist: a physician specializing in problems of the ear, nose, and throat

preprimary impaired: 1) "...a child up to 5 years of age whose primary impairment cannot be determined through existing criteria within R340.1703 to R340.1710 or R340.1713 to R340.1714 and who manifests 1 or more of the following characteristics:

a) Impairment in 1 or more areas of development equal to or greater than 1/2 of the expected development for chronological age as measured by more than 1 developmental scale and which cannot be resolved by medical or nutritional intervention.

b) Lack of appropriate response to visual or auditory stimuli.

c) Inappropriate behavior or affective responses which interfere with normal developmental functioning.

2) A determination of impairment shall be based upon a comprehensive evaluation by a multidisciplinary evaluation team which shall include a psychologist.

3) A determination of impairment shall not be based solely on behaviors relating to environmental, cultural, or economic differences...."(Michigan Special Education Rules, 1980,R340.1711)

recurrent otitis media: middle ear inflammation which occurs at least six times within two years

specific learning disability: 1)"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 imperfect ability to listen, think,

speak, read, write, spell, or to do mathematical calculations. The term includes such conditions as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia. The term does not include children who have learning problems which are primarily the result of visual, hearing, or motor handicaps, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage.

2) The individualized educational planning committee may determine that a child has a specific learning disability if the child does not achieve commensurate with his or her age and ability levels in 1 or more of the areas listed in this subrule, when provided with learning experiences appropriate for the child's age and ability levels, and if the multidisciplinary evaluation team finds that a child has a severe discrepancy between achievement and intellectual ability in 1 or more of the following areas:

a) Oral expression.
b) Listening comprehension.
c) Written expression.
d) Basic reading skill.
e) Reading comprehension.
f) Mathematics calculation.
g) Mathematics reasoning.

3) The individualized educational planning committee may not identify a child as having a specific learning disability if the severe discrepancy between ability and achievement is primarily the result of any of the following:

a) A visual, hearing, or motor handicap.
b) Mental retardation.
c) Emotional disturbance.
d) Environmental, cultural, or economic disadvantage.

4) A determination of impairment shall be based upon a comprehensive evaluation by a multidisciplinary evaluation team which shall include at least both of the following:

a) The child's regular teacher...
b) At least 1 person qualified to conduct individual diagnostic examinations of children, such as a school psychologist, a teacher of the speech and language impaired, or a teacher/consultant."(Michigan Special Education Rules, as amended 8/13/80,R 340.1713)

<u>speech and language impaired</u>: "manifestation of 1 or more of the following communication impairments which adversely affects educational performance:

a) Articulation impairment, including omissions, substitutions, or distortions of sound, persisting beyond the age at which maturation alone might be expected to correct the deviation.
b) Voice impairment, including inappropriate pitch, loudness, or voice quality.
c) Fluency impairment, including abnormal rate of speaking, speech interruptions; and repetition of

sounds, words, phrases, or sentences, which interferes with effective communication.

d) One or more of the following language impairments: phonological, morphological, syntactic, semantic, or pragmatic use of aural/oral language as evidenced by both of the following:

i) A spontaneous language sample demonstrating inadequate language functioning.

ii) Test results, on not less than 2 standardized assessment instruments or 2 subtests designed to determine language functioning, which indicate inappropriate language functioning for the child's age.

2) A handicapped person who has a severe speech and language impairment but whose primary disability is other than speech and language shall be eligible for speech and language services pursuant to R340.1745(a).

3) A determination of impairment shall be based upon a comprehensive evaluation by a multidisciplinary team which shall include a teacher of the speech and language impaired.

4) A determination of impairment shall not be based solely on behaviors relating to environmental, cultural, or economic differences.(Michigan Special Education Rules, as amended 8/13/80, Lansing, R340.1710)

REVIEW OF THE LITERATURE

Introduction

The major issues reviewed in the literature were incidence of otitis media, incidence of allergy, identification of otitis media and learning disabilities, effects of otitis on school performance, and communication among parents and professionals relative to recurrent health problems such as otitis media.

Otitis media often occurs following the onset of upper respiratory or sinus infections or allergy flare-ups. Adenoid obstruction frequently occurs simultaneously, and may contribute to the problem. The otitis may be caused by viral or bacterial agents. Some environmental variables thought to be involved in triggering middle ear changes in vulnerable individuals are crowded, urban living, and early attendance at day care centers. Djupesland hypothesized that anxiety and teeth clenching caused contraction of the muscles of the middle ear, giving rise to changes in middle ear pressure. (Djupesland in Jerger, 1975,p.119) Northern (1976,p.120) reports that sudden temperature changes or chemical irritants in the environment may disturb the function of the cilia and normal bacterial flora in the middle ear.

In healthy individuals the eustachian tube which connects the ear to the throat serves three functions relative to the middle ear. It regulates pressure, protects the ear from contamination from nasopharyngeal secretions, and helps

to clear middle ear secretions. Serous otitis media occurs when the eustachian tube becomes obstructed from inflammation caused by infection or allergy, closing off the middle ear space. As a result, air is absorbed, creating negative pressure and fostering the accumulation of fluid in the middle ear cavity. A conductive hearing loss results when the retraction of the tympanic membrane, or eardrum, and the negative pressure or fluid combine to impede the passage of sound waves from the environment to the inner ear. While significant controversy remains about some of the causes, diagnostic procedures, definitions, treatment, and longterm effects of otitis media, some commonly accepted guidelines are emerging about incidence rates as new research is reported.

Incidence of Otitis Media

Otitis media is one of the most common organic diseases among young children, second only to simple upper respiratory infections.(Paradise,1980,p.917) As children grow from infancy through their third to fifth year of life, the eustachian tube which is central to most middle ear problems changes. The infant's tube may collapse, because the amount and rigidity of supporting cartilage are still inadequate. Also, as the child grows, the tube shifts from a narrow, horizontal one to a wider, more vertical tube facilitating proper drainage. Also, children begin to spend more time awake and vertical, assisting in the drainage of fluid and healthy functioning of the eustachian tube.

Ear infections cost $2 billion a year in the United States. This figure includes doctor bills, transportation to and from doctor's offices, medication, and surgery. During one year, one million sets of ventilating tubes were inserted, and more than 600,000 tonsillectomies and adenoidectomies were performed, many primarily for prevention of further otitis media.(Bluestone, 1982) Kramer reports that among 1905 pediatric office visits 30.5% were for well child care, 20.2% were for initial treatment of otitis, and 13.9% were follow-up examinations of children recovering from otitis media. In the outpatient clinic at a Children's Medical Center most of the 2256 appointments monitored were for treatment of upper respiratory infections. Second and third in frequency of complaint were initial and follow-up care for otitis media, accounting for 20.3% and 6.6% of the appointments. (Jazbi,5979,p.229)

Virgil Howie(1975), a pediatrician interested in otitis media followed 488 of his patients. He identified 149(30.5%) as being otitis prone, which he defined as six or more episodes of otitis before age six. All of these children had their first otitis episode before eighteen months of age. Children with pneumococcus infections were 2.5 times as likely to have multiple episodes. Project CHILD (Conductive Hearing Impairment/Language Delay), an early education program for otitis media children in Toledo, reports that 12% of preschoolers are otitis prone, using Howie's criterion.

Beginning in 1956, the American Academy of Ophthalmology and Otolarygology's Subcommittee on Hearing in Children began work with the Maternal and Child Health Section of the University of Pittsburgh's Graduate School of Public Health in a study of children's hearing. Their goals included:

1. Evaluate methods for testing hearing in children
2. Help establish norms on hearing in children
3. Study factors related to levels of hearing sensitivity
4. Identify physical signs and symptoms which may predict hearing impairment
5. Establish case-find methods to determine the prevalence of hearing impairment in children in the United States
6. Contribute to the understanding of academic, psychological, and social effects of hearing impairment.(Eagles,1963,pp.1-2)
7. Help develop standards for medical and surgical rehabilitation
8. Assist professionals in improving programs for the hearing impaired(Eagles,1967,p.5)

This longitudinal study collected and analyzed comprehensive data on 4078 school children, who as a group were representative of the area population in terms of age, race, sex, socioeconomic status, and parent employment. 97.5% of the children enrolled in the four study schools participated in the project.(Eagles,1967,p.27) The research team included otolaryngologists and trained audiometric technicians working with tightly controlled procedures and carefully calibrated equipment in closely monitored acoustic environments. The study's findings continue to be cited as a standard of comparison for pediatric audiology.

Seasonal variations occurred with the highest incidence during the winter months, when there are more respiratory

infections. Most middle ear problems observed during the study among school-age children were subacute, a type children and parents would not be likely to identify, but one which causes pressure and fluid changes affecting hearing.(Eagles,1967,p.23)

Among the 714 otoscopically normal children who participated for the duration of the study and submitted medical histories, 4% had experienced more than six ear infections during their lives.(Eagles,1967,pp.69-70) Among the 349 otoscopically abnormal, 7.8% had more than six ear infections. (Eagles,1967,p.92)

A recent report from Australia assessed 879 5-year-olds and found only 357(40%) of those children to have normal results on physical examination, impedance testing, and pure tone audiometry. The remaining youngsters had some middle ear abnormality or had ventilation tubes in place for a previously diagnosed middle ear problem.(Silva,1982,pp.26,496)

A smaller study by Onion(1977,p.472) followed 165 children (birth to ten years) for twelve months. They were all seen for index, or first episodes of otitis media. Forty-seven percent had at least one additional episode during the year. Eighteen percent had two or more recurrent episodes, and three percent had three or more. Three-fourths of those experiencing two or more recurrent episodes were male. Eight percent of the children were referred to an otolaryngologist.

Certain populations seem to be particularly at risk for

recurrent otitis media: American Indians and Eskimos, those with Downs Syndrome, brain damage, immune deficiency syndromes, cleft palate, inadequate exposure to language, Whites more than Blacks, and graduates of neonatal intensive care units(NICUs). At Colorado Medical Center's NICU, 28% of the newborns had acute otitis media.(Brooks,1979,p.30) The NICU graduates at greatest risk are those who were born prematurely, received ototoxic drugs without close monitoring of serum levels, and those who required intubation and breathing assistance from a respirator following birth asphyxia.

High Risk Registers have been developed to focus limited resources on screening children most likely to develop problems. The Joint Committee for recommendations for newborn infant hearing screening from the Academy of Pediatrics, Academy of Ophthalmology and Otology, and the American Speech and Hearing Association suggest the following criteria for including a child in the Register.

A. History of hereditary childhood hearing impairment

B. Rubella or other nonbacterial intrauterine fetal infection (e.g. cytomegalovirus, herpes)

C. Defects of ear, nose, or throat (e.g.cleft palate)

D. Birthweight < 1500g

E. Serum bilirubin(newborn jaundice) judged to be toxic

Hearing impairment in this group is likely to occur about fourteen times more frequently than in the general population. (Northern & Downs,1978,p.206)

Freeman and Parkins(1979) report a 20% incidence rate of middle ear disease among learning disabled children(N=50, mean age=10.3 years) and 9.5% incidence rate among those with no apparent learning problems(N=32,mean age=9.8 years). The authors do not identify the guidelines used to label the learning disabled children as being handicapped, nor the techniques for selecting controls. The ages of the children exceed those in the current study.

Ingham Intermediate School District, the coordinating and funding organization for constituent school districts in Ingham County, Michigan, conducted an audiometric screening of 104 students attending special education classrooms for the pre- primary impaired in 1981. Audiologists used pure-tone and impedance testing to identify hearing losses or middle ear problems which might interfere with school success. Eight students already had ventilating tubes in place. One student was newly identified as having a sensorineural hearing loss. Twenty-eight additional students failed the screening and were referred for further testing. Twenty-three of those referred participated in the follow-up and nineteen of them were found to need treatment of middle ear problems ranging from removal of impacted cerumen (wax) to surgical intervention. These students had already been identified as having a handicap, including a language delay in most cases. Typically, the twenty students newly identified as having hearing problems would not have received audiometric testing beyond the routine public health technician

puretone screening. When the screening was repeated in 1982, thirty-six (35.51%) of the 107 children tested had confirmed middle ear problems.(Dickie,Stewart,Johnson,1981)

A study at the University of Indiana Speech and Hearing Center reports that among clinic children with language problems, many of whom have been identified as learning disabled, 60% have some degree of hearing loss, and most of those have histories of chronic otitis media.(Naremore,54)

In summary, most young children experience at least one episode of otitis media. Many, particularly those in high risk groups, experience multiple episodes which sometimes continue into the school years. The causes vary, but most commonly otitis media is seen in conjunction with other upper respiratory symptoms.

Symptoms Warranting a Medical Referral

With the onset of acute, or infectious otitis media, there is often rapid onset of pain, fever, congestion, and malaise. With serous otitis media, however, the observable signs are often more subtle, and persist as an acute episode appears to be resolved. The student may:

1. look tuned out when the teacher speaks to the class
2. respond inconsistently to sound
3. confuse similar sounds
4. need to have verbal directions repeated
5. have difficulty monitoring loudness of own voice
6. not remember names of people, places, objects
7. be unusually sensitive to noise
8. experience difficulty sequencing sounds correctly
9. attend only to part of a message
10. have difficulty localizing sounds
11. complain of bubbling or clicking noises in the ear upon swallowing or changing position
12. complain about food making loud noises when chewing

13. show temper outbursts from frustration or confusion
14. fatigue easily from listening
15. complain about tinnitus, or ringing in the ears
16. experience vertigo, a sensation of spinning

If a student exhibits several of these behaviors, it may well be appropriate to refer the child for multidisciplinary diagnostic testing. This would be particularly true if there were a history of recurrent otitis media, language delay, or if the child is in a high risk category. The fact that the child may have passed routine public health hearing screenings would not change this recommendation.

One behavior which often confuses staff members and causes them to be reluctant to refer for testing is that the student appears to hear well in noisy situations. This is explained by a phenomenon called paracusis Willisii. As the noise level increases, people compensate and speak louder. (Davis,1978)

Allergy

The expected incidence of allergy is 15% for the general population according to the National Institute of Allergies and Infectious Diseases. Children with allergies can have any of a broad range of substances affect them in one or more ways. Congestion, hives, wheezing, eczema, stomach cramps, excessive perspiration, sallow complexion, circles under the eyes, and itching eyes are among the more commonly noticed symptoms. The allergic-tension-fatigue syndrome in which the child tends to be irritable, anxious, or excessively tired is commonly present as well. Medical treatment

and environmental control can alleviate the problems to varying degrees.

Laboratory tests sometimes ordered by pediatricians to determine whether to refer to a specialist are not as reliable as had been thought for young children.(Nelson,1982; Roach,1981) Some families are told by physicians that their child's problem is not one of allergy, when actually the serum complement and IgE tests had false negative results.

Allergic rhinitis, commonly referred to as hay fever, occurs in five to ten percent of the elementary school age population. When allergic rhinitis occurs in combination with serous otitis media, the primary treatment according to many physicians is allergy control. Management typically includes elimination of suspected food allergens from the diet, environmental control, prevention of complicating bacterial infections, oral antihistamines or decongestants, and hyposensitization to certain inhalants with allergy shots.(Dockhorn,1977,p.111)

Among the 714 otoscopically normal children who participated for the duration of Eagles' study and submitted medical histories, 11.5% had history of food allergy, asthma, eczema, hay fever, and/or hives.(Eagles,1967,pp.69-70) Among the 349 otoscopically abnormal, 11.2% had history of allergy.(Eagles,1967,p.98) There was no increased allergy rate among those with otologic problems.

Reisman and Bernstein found the incidence of allergy to be 35% among 200 children who required multiple tympanostomy

procedures for otitis media, that the otitis was a complication of nasal allergy.(Ghory,1982)

McLoughlin(1983) recently completed a study concerning the relationship of allergies and allergy treatment to school performance and behavior. His sample included 316 allergic and 84 nonallergic children ranging in grade from nursery school to grade twelve. The problems reported were allergic rhinitis(86%), eustachian tube dysfunction or serous otitis media(57%), asthma(58%), gastrointestinal symptoms(36%), and hives(29%). The allergic children missed one to three days of school per month, which was more than their peers. Most of their absences were in winter. Drowsiness in school was reported significantly more often for the allergic children. Eustachian tube dysfunction was significantly related to inattentiveness and excessive talking. It was also significantly associated with lower ratings by parents on reading, math, spelling, writing, listening, and speaking.

In terms of treatment, parents considered antihistamine use to correspond with hyperactivity. Theophyllin bronchodilators correlated with inattentiveness, hyperactivity, irritability, drowsiness, withdrawn behavior, and being difficult to handle. McLoughlin concluded that respiratory problems related to allergy may influence allergic children's ability to attend to auditory information, particularly during early speech and language development. He went on to say that the "general feeling of illness...associated with

allergies may deter a child from normal behavior. This may be particularly true of the learning disabled child who must cope with many other problems."(McLoughlin,1983,p.11) In an earlier presentation McLoughlin spoke of parents sending allergic children to school regularly, because they are sick all the time. Teachers need to be sensitive to the child's symptoms and help the parent determine when medical treatment is warranted. Another point in the same presentation was that part of the reason for chronic drowsiness may be difficulty sleeping at night due to allergy symptoms. (McLoughlin,1982,CLD) He encouraged more systematic monitoring of school effects of medical treatment.

Audiological and Medical Diagnosis of Otitis Media

Puretone testing is generally accepted as one part of the assessment for otitis media, but the frequencies to be tested and the intensity of sounds presented at a screening level continue to be cause for debate. Katz(1978,p.53) recommends including 500Hz and 6000Hz in addition to the 1000, 2000, and 4000Hz measures. He also recommends testing at 15dB(ANSI,1969) as opposed to the commonly used 20 or 25dB levels.

Northern and Downs(1978,p.219) believe that 20dB is the softest practical screening level in schools because of ambient noise. They also reject use of the 500Hz component for screening because these results are particularly affected by the ambient noise. In response to concerns such as these, for school screenings Katz(1978,p.54) recommends that

testing room be distant from fluorescent lights, water coolers, rest rooms, and elevators to minimize auditory background problems. He also suggests minimizing visual distractors.

Recommendations for who should be screened vary. Northern and Downs(1978,p.221) suggest testing all kindergarteners, 1st, 3rd, 5th, and 7th graders, plus all transfer students kindergarten through high school. In addition, they recommend rechecking all students who failed a screening previously, until they have three years with no decline in pure tone performance.

Many studies report that puretone screening only identifies about 50% of otitis media hearing losses. If children fail initial screening tests, they typically are re-screened with threshold testing in the school, identifying the softest sound levels at which they can perceive sound. Usually if they fail this second test they are referred to their doctor and/or an audiologist.

Speech reception thresholds tested in diagnostic evaluations measure the softest level at which the child can understand 50% of what s/he hears. The test includes spondaic words presented by tape or live voice for the child to repeat. A spondee is a simple, two syllable, compound word with equal stress on each syllable (e.g. cowboy, ice cream). The test's primary contribution is to verify the accuracy of the puretone results.

In the past several years, a simple, painless procedure

called impedance audiometry has become one of the primary diagnostic aids for otitis media, generally being coupled with puretone threshold testing and speech reception threshold testing. It requires minimal cooperation and no active responses from the patient. A probe with a soft cuff is inserted into the patient's ear canal and forms an air seal. A known amount of sound is sent to the ear through the probe, and then the quantity reflected back from the tympanic membrane is recorded. The Tympanometer records middle ear pressure, eustachian tube function, and information about eardrum mobility as it measures the flow of sound energy under conditions of changing ear canal pressure. The American Speech and Hearing Association(ASHA) considers -50 to +50mm water to be the normal range. Readings beyond -100mm are outside the 90th percentile and are frequently recommended by audiologists as the criteria for medical referral.(Rintelman,1979,p.290) Often physicians do not become concerned until the negative pressure exceeds -150mm and persists at that level.

The Tympanometer also tests the acoustic reflex, which measures whether the stapedius muscle contracts when a sudden, loud tone is sent to the ear. The acoustic reflex is frequently absent in the presence of otitis media. It is typically suggested that any mildly abnormal findings be rechecked at two or four week intervals before referring to a physician. In the event of a referral, a physician supplements the puretone, speech reception, impedance, and

acoustic reflex tests with a physical examination and occasionally a fluid culture.

A position statement from the American Speech and Hearing Association in 1980 encouraged participation of speech-language pathologists and audiologists in initial assessments of students suspected of having a learning disability. There has been a continuing increase of language disordered individuals on speech-language caseloads, many of these students being learning disabled. Members of the Association feel that "the majority of learning disabled students have concomitant language disorders and that it is essential that professionals qualified to determine the absence or presence of language learning disorders... be included on the multidisciplinary team."(Byrne,1980)

Early Identification of Learning Disabilities

There are developmental attributes, which permit evaluation of risk for learning disabilities in the preschool years. They are measurable prior to many of the characteristics listed in the federal definition. Parents often report observing differences from the norm with their child from an early age. These differences in pattern and rate of development are supported by professionals. Wiig(1976,p.4) finds they may have allergies, colic, and other physical problems which require parents to handle them differently as infants, and that deficits may result in subtle changes in the quantity and quality of interaction between parent and child. Parent responses of guilt, overprotection, and rejection may

contribute to the development of secondary emotional problems. Ack(1982,p.19) states the following.

> Ideally, a child who may have a learning disability should be evaluated as early as age three, before he begins to view himself as a failure and to be regarded as slow by others....
>
> Feeding, sleeping, and regulating temperature are the reading, writing, and arithmetic of the first three years of life. Be alert for the child who has difficulty listening or attending to others, or putting his own thoughts together. A short attention span or a tendency to impulsiveness in the hyper- or hypoactive child may be a tip off...abnormal difficulties for his age in integrating visual input with proprioceptive input, auditory input with visual input, and so on... abnormally poor posture and extraocular muscle control ...underdeveloped visual orientation to space,... overly distractible, or...hypersensitive to noise, late in learning to speak and difficult to understand when he does speak,--a child who stutters,...(has) problems with word finding, sound sequencing, narrative organization or speech comprehension

Wiig(1976,p.304) lists similar indicators for three year olds and adds aggression, poor interpersonal relationships, disinterest, and anger.

By school age, some visual-motor difficulties often associated with learning disabilities include difficulty holding pencils, cutting with scissors, tying shoes, and zipping zippers. Wiig(1976,p.304) feels that the best predictors for learning disabilities from kindergarten reports are immaturity, poor social and emotional adjustment, poor speech and language, and impulsiveness. Willeford mentions a problem of not being able to follow class activities well which often results in the child not being selected for gym or recess teams, because his peers say that he "goofs up too much." He may also prefer to be alone or with individuals

younger or older than him/herself.(Willeford in Clark,1978)

Language problems common to learning disabled children are easily missed in an assessment done only by a psychologist, teacher/consultant, and classroom teacher. The subtle difficulties often are not tapped by many standard assessment batteries. Issues Wiig recommends for review include:

1. Normal spontaneous speech, but problems with structured linguistic tasks such as sentence repetitions,completions, or transformations.
2. Poor knowledge of morphology--plurals, tenses...
3. Long response latencies
4. Difficulty understanding jokes, puns, metaphors, or words with multiple meanings
5. Poor recall of details pertaining to space, time, and quantity
6. Poor sensitivity to nonverbal social cues
7. Delay in comprehension of abstract concepts
8. Classification difficulties
9. Poor semantic relations or analogies
10. Use of many indefinite nouns and pronouns, limited bank of adjectives and adverbs
11. Difficulty decoding blends with L,W, or R as the second letter in the word
12. Confusion in reading and spelling words with short A,E,I beyond the first grade
13. Difficulty understanding sentences written in passive voice(Wiig,1976)

Cole and Wood(1978,p.120) add to the list of problems that learning disabled children are often unable to use verbal information to make inferences or draw conclusions. Dobie(1979,p.50) suggests that syllable counts may be preserved, but words and their meanings may change--e.g. "meticulously done" may be understood as "ridiculously dumb".

No one or two of the characteristics would qualify a child as being learning disabled, but if a significant cluster exists in combination with the child's inability to meet regular classroom expectations, then identification would be

appropriate.

Effects of Otitis Media

Some of the effects researchers frequently attribute to recurrent otitis media are

1. Mild, low frequency hearing loss, especially problematic in suboptimal listening conditions
2. Reduced verbal skills and scholastic performance, particularly in language areas
3. Distractibility and fatigue caused by pain and malaise or by medications prescribed to treat the otitis

Serous otitis is the most common cause of hearing impairment in five and six year olds.(Naunton,16) Conductive hearing loss, the type often associated with otitis media, accounts for 90% of school age hearing impairment.(Brooks, 1978,ch.25) Most researchers agree that otitis media triggers a 15-30dB conductive hearing loss, and that even this slight loss in young children may affect language development and later school performance even though the actual hearing loss will have resolved. The loss tends to be greatest at low frequencies(250-1000Hz) with some recovery at 2000 and 4000Hz. The loss may be intermittent or persistent, and has the greatest potential of affecting language when it occurs before the age of two, reoccurs frequently, and persists for at least several months.

The mean hearing levels across frequencies from Eagles' project are reported in chapter four as a contrast to the

findings in the current study. They found differences between mean levels of all right and left ears to be less than 1dB, with differences in standard deviations of $\leq$0.5dB. They found neither ear to be consistently more sensitive. This finding is not usually recognized as being representative of the population as a whole, with many researchers identifying the right ear as being dominant for most individuals. Girls had slightly ($\leq$2dB) more sensitive hearing at most frequencies. Across races the difference in means was <2dB. There was some increase in hearing sensitivity across age, but primarily with 11-13 year olds, children older than those in the current study. The researchers correlated this finding with the decreased prevalence of upper respiratory infections and related middle ear problems in the older children. Among children with complaints about recent colds or ear problems the hearing sensitivity was about 5dB higher than those without this history. Also, they felt that students' increasing familiarity with the testing might affect the results. This fairly stable picture across sex, 6-9 years of age, and race help to make the results more easily generalized to areas other that Pittsburgh.
(Eagles,1963,pp.87-94;1967,p.12).

Among the 41.7% of the 4078 children with history of at least one ear infection, there was a greater frequency of slight hearing loss, but some with ear infection history had normal hearing. 8.5% of the subjects had one hearing impaired parent, and 0.3% had two hearing impaired parents.

(Eagles,1963,p.217) Some with otitis history showed a progressive hearing loss over the course of the study.

Kessner(1974) completed a study for the National Academy of Science assessing 1639 4-11 year old children in the Washington, D.C. area. He found that in the speech frequencies(500-2000Hz), the mean difference in hearing thresholds between children without history of otitis media and those with recurrent otitis history was 7.4dB(ANSI,1969). Thresholds for the normals were 7.8dB, and the children with definite serous otitis media had a mean threshold of 15.2dB. Using 15dB as the criterion for significant hearing loss, 78.8% of the six and seven year olds had normal hearing in both ears across speech and non-speech frequencies, and 84.8% of the eight and nine year olds had normal hearing. (Northern & Downs,1978,p.2)

Project CHILD (Conductive Hearing Impairment/Language Delay) serves preschool otitis media children (0-5 years) through the Toledo Public Schools, The Medical College of Ohio Department of Pediatrics, and Toledo Headstart. As part of the needs assessment, Project staff sent a survey to 310 Toledo physicians who specialize in pediatrics, family practice, and otolaryngology. One hundred fifty-nine responded.

Their responses indicated the following:

TABLE 1

Project CHILD Survey of Physicians: Effects of Otitis Media

To what extent does chronic otitis media cause:

	Not at all	Rarely	Occas.	Often	No Resp.
language delay	2.6%	18.5%	39.1%	29.1%	10.6%
social delay	4.0	22.5	34.4	27.8	11.3
learning problems	2.6	15.9	35.8	35.8	9.9
articulation prob	2.6	19.9	37.7	28.5	11.3

The majority of physicians responding to the survey felt that otitis media had the potential of affecting school success.(Project CHILD,1981)

In Freeman and Parkins' learning disability study, the audiometric and physical examinations were done blind relative to school and middle ear history. The testing was done in a "relatively quiet classroom", not a sound suite. The work is more recent than Eagles', and includes impedance testing. The average hearing thresholds in the speech range was 3.9dB for the controls and 7.5dB for the learning disabled children. The results suggested to the researchers that "middle ear disease and its resultant hearing loss may be an additive factor in causing greater learning difficulties for an already deprived child." The researchers do not define "deprived", which may represent cultural deprivation, deprivation of the usual opportunity for success in school

because of a learning disability, or possibly some other meaning. Because these characteristics of the children are indefinite it is difficult to generalize the results to other populations.

Some environmental variables reported to affect the severity of an otitis child's difficulty in school include:

1. signal to noise ratio
2. vocal power output and sex of teacher
3. acoustic environment of classrooms
4. school absences due to medical appointments
5. school absences due to illness

Harrison completed a study of ambient noise in thirteen schools and found the median level of 44dBA with prolonged periods of greater than 50dBA and peaks of up to 60dBA. In follow-up simulations testing children with the background noise, only thirty of the thirty-two children with normal hearing passed the test.(Brooks,p.37) Byron's study in an open school yielded an average level of 68dBA, a range of 62-74dBA, and the only room quieter than 50dBA was the head-master's office.(Brooks,p.37) Bess reports that modern, acoustically treated classrooms are about 41dBA unoccupied and 56dBA occupied. The signal to noise ratio(S/N) is about +5dB in high schools and +1dB in lower grade rooms. He reports that the most important factor in determining S/N ratio is the distance between speaker and listener, that sound pressure decreases by 6dB when the distance is doubled. A teacher speaking in a normal voice to an elementary child

three feet away will have a +9dB S/N ratio. At six feet, it will be +3dB.(Bess,1981,p.190)

In addition to coping with problems with the school acoustic environment and school absences, the fluctuation in a child's own hearing sensitivity makes it necessary for the child to re-adjust listening skills, because s/he hears words and sentences differently at different times. The effects of otitis media on language have been studied in two ways.

1. assessment of individuals with known history of middle ear problems
2. simulations of speech, filtered in such a way as to be comparable to middle ear problems--and then assessment of individuals' performance under those conditions(Dobie,48).

Holm and Kunze(1969) tested thirty-two children five to nine years of age. They were in good health except that the sixteen students in the experimental group had a history of early onset otitis media. They experienced fluctuating, mild hearing losses, and lower scores on language tests relative to a matched control group. Their performance on visual tests was similar to the control group's.

Kaplan(1973) completed a study among Eskimos, a known high risk group for otitis media. He followed 489 children from birth to seven or ten years. In addition to finding hearing loss, he found that 34% of all children were behind in school placement, but that 63% of children repeating a

grade in elementary school had their first episode of otitis media before age two. The early onset otitis media children had scores on the Wechsler Intelligence Scale for Children and the Metropolitan Achievement Test which were statistically significantly below the norm. Also, it appeared that the school performance of the early otitis media group and the control group widened as time went on.(Northern & Downs, 1978,pp.6-7) One implication of this study for schools, is that it costs well in excess of $1000 for any child to repeat one year of school. One caution with this study is that the impact of socioeconomic status is not controlled in considering the outcomes.

In the Australian study,(Silva,1980) those experiencing bilateral otitis media with effusion(N=47) as determined by a Type B Tympanogram in conjunction with microscopic characteristics of otitis media were compared with otologically normal children.(N=355) The otitis media children shared a pattern of developmental disadvantages and behavioral problems including poor speech articulation, low verbal comprehension, poor motor development, lower intelligence, dependency, short attention span, weak goal orientation, restlessness, peer rejection, and frequent disobedience. The authors note the similarity of this constellation of characteristics with the constellation often viewed with learning disabled children. The type and severity of effects reported were influenced by the age of onset of the condition, its severity, and the length of time over which it continued to

occur. The effects may also be compounded by cultural deprivation, bilingualism, and other situations which often hinder successful school participation. Another Australian study by Lewis(1976) reports similar results with a conclusion that serous otitis media tends to encourage inefficient listening strategies that can persist well beyond the episodes of active ear disease.(Northern & Downs,1978,p.5)

A number of animal studies show that anatomical changes occur causing permanent central auditory processing problems if there is sound deprivation during key developmental periods.(Webster & Webster,1980) Peripheral hearing occurs from the outer ear through the 8th cranial nerve, and central auditory processing relates to brainstem and cortical function. In humans central auditory processing encompasses attention, sequential memory, sound blending, discrimination, and closure skills. Willeford(1977) questions whether memory is actually a problem, or whether the material is never learned in the first place. Problems with central auditory processing based on minimal hearing losses can be better understood if the speech sounds most affected are reviewed. The unvoiced consonants (f,k,p,s,sh,t,th) are generally very soft, easily missed, and affect the understanding of the word meanings as well as grammar issues such as pluralization or tense.

Zinkus and Gottlieb(1978) focused their research on auditory processing and academic achievement as they relate to otitis media. A team assessed forty white, middle class,

elementary school children referred to a multidisciplinary evaluation team because of academic underachievement. The students were divided into a mild otitis and a severe, chronic otitis group. The students in the "mild" group had experienced no more than one mild episode during each of their first three years of life. The chronic group had all experienced multiple otitis episodes that had required surgical intervention to alleviate the problem. The average ages of the students were 8.6 years in the mild group and 8.3 years in the severe group. Excluded from the population were subjects with (1) suspected central nervous system(CNS) disease or injury; (2) severe emotional or behavior disorders; (3) visual perception disorders; or (4) IQs below 85. They found normal motor development in the chronic group, but delayed language development. All three mean summary scores for the chronic group on the Wechsler Intelligence Scale for Children-Revised(WISC-R) were lower by 8 to 10 points. The subtests on which the groups performed differently at a .05 level were those which relied heavily on auditory processing or language. Children in the chronic group also experienced difficulty performing tasks requiring integration of visual and auditory skills. The correlation between the WISC-R full scale and reading level was not statistically significant.

The list of exclusion characteristics eliminated from this study many students who might be identified as learning disabled. Most learning disabled students have a combination

of visual and auditory problems, and their medical histories typically include some significant CNS risk factors. The nature of the population may have contributed to the somewhat atypical finding that WISC-R Performance scores were depressed in the chronic group. Most studies report that there is no effect on non-verbal intelligence.(Rapin,11)

During the 1981-1982 school year the writer completed a field placement at Sparrow Hospital's Developmental Assessment Clinic, a follow-up service for all graduates of the hospital's regional neonatal intensive care unit. In that setting, where most of the children could be considered at high risk for learning disabilities, it appeared that an unusually high percentage of the children were experiencing otitis media, often repeatedly, and often beginning within the first year of life. In many of those cases there was also concern about the possibility of mild hearing impairment which may affect language development.

To assess the otitis media and language link an additional study was completed during which the Clinic's primary physician completed a checklist on all 13-40 month old children who visited the clinic when he was scheduled there from November, 1982, to September, 1983. Of the seventy-one children followed, forty-nine had language within normal limits for age. Fourteen had questionable language skills, and eight had clearly abnormal language for age. The language assessment included the Bayley Scales or Stanford-Binet, combined with the Bzoch-League Receptive Expressive Emergent

Language Scale (REEL), and staff observation. The mean number of ear infections per year for the three groups in order were 0.7, 1.4, and 3.9, a statistically significant pattern on an Analysis of Variance (df=2,F=16,p=.0000). With the intermediate group removed from the analysis, because the prognosis is less certain, the F score increased to 34.08.

Paradise(1981,p.870) wrote an article discussing the problems often observed in individuals who have a chronic history of otitis media. He raised questions of association, cause/effect, and reversibility. He does not believe that conclusive cause/effect evidence exists yet for most of the problems identified, and he emphasized that the initial factor that led to the otitis media may also be responsible for the other problems. One example he used was that individuals with poor parenting skills might not employ consistently good hygiene for their child, might not notice or respond to mild symptoms of illness, and might frequently prop feed a baby its bottle, which is known to contribute to blocking the eustachian tube. The same parents at a later time could be minimally involved in fostering their child's formal education. To attribute the later academic deficit to the otitis is inappropriate. A preferred approach is to suggest that an otitis child who is also at risk for school problems for other reasons, is more likely to be handicapped by the health history.

Looking at interaction of variables from another psychological perspective can be done with the locus of control

concept usually associated with Rotter. It addresses people's beliefs about connections between their behavior and their achievements or others' responses to them. Individuals who believe that their own efforts and skills are the primary bases for rewards or punishments they receive are considered to have an internal locus of control. Those who attribute their successes or failures to luck or influence of others are said to have an external locus of control. It is also possible to be Internal for success or failure, and External for the other. It is generally accepted that individuals with an internal locus of control work harder to control their environment, persist longer on challenging tasks, have better mental health, and achieve higher levels of academic success than those with an external locus of control.(Gordon,1977;Williams,1979;Travers,1979)

As children grow from infancy through the elementary school years they tend to shift from viewing their experiences as being externally controlled to believing in an internal locus of control as they see ways they can influence outcomes through their own behavior.(Bachrach,1977,p.1340) It is a reciprocal growth pattern with success yielding increased self-confidence, yielding increased effort for further success, and so forth. The rate of this cognitively based development can be affected and sometimes permanently impaired by a variety of factors such as socioeconomic status as well as rate and pattern of reinforcement for on-task behavior.(Gordon,1977;Bradley,1977)

Some recent research indicates that learning disabled children, like others who experience wchool failure, are more likely to maintain an external locus of control than their classmates. In particular, they tend to attribute their successes to external factors, more than their failures.(Nicholls,1979;Pearl,1980;Dudley-Marling,1982) The Vanderbilt study on chronic illness in children reports research which clarifies that the presence of a continuing illness often fosters a reality based external locus of control for both child and parent. A couple of reasons identified for this include the unpredictability and limited control over recurrent episodes of illness or hospitalization and reduced parent career flexibility because of health insurance needs and geographic ties to individual specialists or facilities. In a limited way the Vanderbilt research may be applicable to learning disabled, otitis media students. Pearl and Bryan's research(1982) about mothers' locus of control relative to their learning disabled children found a pattern of external locus of control for achievement and internal locus of control for failure. The population was small, eighteen parochial school families, but provided an initial look at how members of a family can reinforce less than optimal motivation strategies for children with learning disabilities.

Otitis media can have a range of longterm effects for some individuals who experience recurrent episodes. The most thoroughly documented effect is slight conductive hearing

loss with varying duration. There are reports of effects on language development, particularly if the otitis occurs during key language development periods and if the child is a member of a high risk category for learning problems. Reports of effect on behavior vary, with some studies identifying distractibility, altered activity levels, and irritability being directly related. Studies of locus of control among chronically ill or learning disabled children and their families may be applicable to learning disabled children with recurrent otitis media.

Communication Among the Parents and Professionals

Johnson and Morasky(1980,p.189-190) identify three general categories of communication problems among professionals working with learning disabled youngsters:

1) problems relevant to interpersonal relationships and role definitions;

2) problems related to clarity, form, and structure: needs to reduce jargon, to describe behaviors in measureable terms, to state specifically what is sought from the other professional, and

3) problems related to purpose, knowing how the requested information will be used guides the professional in presenting it appropriately

These types of problems are identified repeatedly in the literature as affecting open, complete communication among parent, teacher, and doctor.

In the Sparrow DAC and Ingham ISD studies, it appeared that the parents who were most actively involved in acting

as advocates for their children, had been under prolonged, significant stress relative to medical problems and had received conflicting medical or educational diagnoses or recommendations for their child previously. Some expressed that doctors were insensitive to this stress. Most believed their child had a problem long before doctors or school personnel acknowledged or confirmed it. These parents quickly contacted program supervisors in school settings both when pleased with their child's curriculum and support personnel and when there was any confusion or question about compliance with details of the child's Individual Education Plan. In health situations, these tended to be the parents who called doctors quickly when they suspected an illness might be starting. Some mothers stated explicitly that they were uncomfortable with some of their own actions, but felt they had to act this way to get the services their child needed.

Paradoxically, another set of parents with experiences similar to the former group's comprised the majority of the opposite end of the involvement continuum, refraining from contact with school and medical personnel whenever possible. When they did meet with personnel, their involvement tended to be noticeably more passive than many other parents.

In the hospital and ISD screenings, communication regarding children's performance following initial referral was a problem. The hospital's clinic receives limited feedback from schools and private agencies to which they refer

children for treatment, making it difficult for them to assess the appropriateness of the referrals and the outcomes for the children. Ingham ISD had difficulty obtaining parent consent for free follow-up medical evaluations on the children with abnormal audiometric findings. When they rescreened the following year, several of the same children were again found to have middle ear problems. Also, the ISD data is not organized in a way to permit progress checks on the children who "graduated" from the preprimary programs into other general and/or special ed programs.

Historically, communication between schools and physicians has been limited and strained. Often it has been easiest to have parents act as liaisons with clearly written information to be shared. Direct communication is preferable concerning observed behaviors in school, possible side effects of medications, and manageable modifications in the school environment which may assist the child's performance.

A related problem occurs when the school and/or parents feel that a medical specialist's opinion is warranted and the primary care physician disagrees. The reasons for this vary, and often take time to resolve to the satisfaction of all involved parties. The pediatrician may be reticent to alarm parents, a reaction that may be anticipated with any referral to a specialist. The pediatrician may also feel that medical treatment of the problem or physical growth of

the child may yield resolution if given a longer period of time, and that an otolaryngologist might insert ventilating tubes prematurely. Some health professionals view the risks and problems of ventilating tubes to be greater than the risks and problems of otitis media.

Project CHILD's survey of 310 Toledo physicians included a section on referral practices. Their responses indicated the following:

TABLE 2

Project CHILD Survey of Physicians: Referral Criteria

If a child has both a hearing problem and a language delay, do you refer to:

	Never	Some	Freq.	No Resp.
Child's School District	15.9%	18.5%	11.3%	54.3%
Toledo Hrg/Speech Center	7.9	23.8	33.1	35.1
Toledo Public Schools	17.2	17.9	7.3	57.6
Other	1.3	9.3	27.2	62.3

Twenty-eight percent of the 159 respondents evaluate language development formally, with most using the Denver Developmental Screening Test. During the past two years, 51.7% had attended a continuing education program on otitis media, and 86% had read material on otitis media. Forty percent had changed their mode of therapy for otitis during this time. Forty percent reported using screening audiometry in their office, and 14.6% reported using tympanometry.

15.9% reported no contact with school personnel about children at risk from otitis media, 34.4% very little contact, 25.8% some, 9.9% quite a bit, 2.6% a great deal, and 11.3% no response. In the presence of hearing impairment and language delay, most refer the child for some special service. (Project CHILD,1981)

The information gathered represents a far more ambitious effort than most school districts have undertaken, but the utility of the findings is limited. Since there are no stated parameters of hearing impairment or language delay, it is not clear how severe a problem would have to be before a referral would occur. Responses would be more meaningful if the source of referral concern (parent or doctor) were also disclosed.

A 1983 study by the American Academy of Pediatrics reviewed physicians' roles in planning programs for children with handicaps. Physicians' participation is school district Individualized Educational Planning(IEP) meetings is reducing according to a survey responded to by 216 pediatricians. The physicians' perceptions were that:

> Primary care physicians seem willing to assist with school related problems, however, few engage in services or methods of communication considered productive i.e.visiting classrooms, attending staffings. They generally would not modify their practices to permit more involvement even under ideal conditions.
>
> Primary care physicians have little opportunity to contribute to IEP decisions directly. Only 55% had any contact with a school regarding a placement, and only 21% report being informed of an IEP before it occurred. Parents informed physicians of IEP placements twice as often as school personnel.

> No consistent pattern of communication between physicians and school personnel exists across schools, and provision of medical information is incomplete. A standard communication mechanism was identified as the factor most likely to produce change.
>
> Primary care physicians have minimal contact with schools. 41% report no contact. Another 43% report communication about once a month. When the school requests medical expertise, it is generally sought from a specialist, with the primary care physician's completion of the school physical form being seen generally as the physician's chance to provide all the information s/he can. The school nurse tends to value the physician's contributions more than other personnel do. School personnel generally do not perceive primary care physicians as playing a large role in placement
> decisions, nor do they perceive it as their own role to inform physicians of placement decisions.
>
> The relationship that a school district develops with its local physicians seems to depend, in part, on the interest and availability the physicians. When they are responsive to the needs of the child and school, they may be used extensively.

Based on the survey, the American Academy of Pediatrics recommends that the school physical form be revised to include more opportunities for primary care physicians to provide input, and to let the physicians know that this may be their only mechanism for participating in IEP placement decisions. School districts should notify primary care physicians prior to IEPs, and they should include a request for additional relevant, medical information and an invitation to participate in the IEP. Through continuing education, both school and medical personnel should be made aware of the potential value of a more systematic method of communication and some techniques for achieving this end.

A variety of communication problems exist among

parents, teachers, and physicians concerning children with current or previous medical problems and children with learning problems. There are varying opinions about who has the authority to speak with whom about what subjects, in what degree of detail, and for what purposes. Frustration with the current situation has been expressed by many individuals involved, and some recommendations for change are surfacing.

Medical Treatment of Otitis Media

One way to improve communication among parents, teachers, and physicians is for the parents and teachers to have a better understanding of the medical condition, possible treatments, and what concerns physicians might have about certain treatments.

Some cases of otitis media are self-limiting, require no medical or surgical intervention to resolve, and leave no residual effects. The treatment in infants can sometimes be as simple as explaining to parents the importance of holding the baby upright when feeding a bottle, rather than allowing it lie flat, making proper swallowing and drainage possible.

Medications can include prophylactic and standard use of antibiotics over a longer period of time than the standard course. Oral decongestants and/or antihistamines help relieve related upper respiratory congestion in many cases. In some situations, special diets, pneumococcal vaccine, mucolytic agents to thin the middle ear fluid, nasal steroid inhalants, allergy avoidance programs or desensitization

series are prescribed.

Sometimes myringotomies, incisions in the tympanic membranes, may be effective without the insertion of ventilation tubes. Occasionally this is done in combination with an adenoidectomy. In some cases however, insertion of ventilation tubes is the treatment of choice, typically after nonsurgical interventions have failed. The concerns typically associated with tubes include the risks of general anesthesia, the daily difficulties of keeping water out of the ears during bathing, and the occasional problems of permanent damage to the tympanic membrane. The risk of the latter is usually considered to be less than the risk of damage from allowing the otitis media to continue unresolved.

The risks to be considered across procedures include parent noncompliance with prescribed procedures, adverse reactions to drugs prescribed, stigma for the child from peers or adults, and the burden of financial costs to the families. In the recurrent cases of concern here, there is often a delay in medical treatment taking effect or surgical intervention being arranged even after diagnosis has occurred and treatment has begun.

If parents and teachers know what to expect from physicians and the medical or surgical treatment provided, they can be more helpful in the child's care and providing the appropriate accommodations in school.

METHODOLOGY

Criteria for Selection of Subjects

School districts, buildings, and personnel were selected in the Lansing area according to participating local district research guidelines and following staff member indications of willingness to participate. Twenty-five learning disabled students in the Lansing area were selected according to the following criteria:

A. 6,7,8 or 9 years of age
B. Child and parents fluent in English
C. Parent/guardian a biological relative of the child
D. Singleton (not a twin...)
E. No known significant stress in immediate family during three months prior to this study: birth, major illness, separation, death
F. Wechsler Intelligence Scale for Children--Revised (WISC-R) on file

Children must be at least six years old to have the WISC-R administered, and this was to be the only consistent school performance indicator collected. Relatively few children are identified as being learning disabled before age seven, so the age range was set at four years in order to limit the number of participating school districts needed for the study. The English fluency requirement was adopted in order to minimize the number of variables affecting the

children's performance as well as to insure parent understanding and correct completion of the Child Development Questionnaire. Only students living with a biological relative were included in order to maximize the likelihood of the availability of complete family history information.

One set of twins was included after approval was received from two committee members. The reasons for originally planning to exclude twins were

A. Twins are generally born prematurely at very low birthweights, and are therefore considered to be neurologically at greater risk for learning problems.
B. The second born(B) twin is generally considered to be particularly at risk for learning problems
C. It seemed to the writer that it would be difficult for parents to remember with accuracy per child some of the details requested in the child development form

In this situation, the male fraternal twins' gestational ages were 42 weeks(normal term + 2 weeks), and their birthweights were 6lbs.13oz. and 7lbs.03oz. It was the A twin who was learning disabled, and the B twin was excelling academically. Finally, the pediatrician serving the family from the time of the twins' birth was doing research on twins. As a result of this family's participation in that research, the mother had extremely detailed developmental records on both boys.

The issue of family stress was based on a concern about overloading a family unnecessarily as well as a pragmatic question about whether a family with recent, major problems would comply with all aspects of the study with as much attention and accuracy as other participants.

Twenty-five matched control subjects were selected from the same schools, who met criteria A-E above, had not been identified as handicapped at any time in the past, and paralleled their learning disabled peer in the following ways:

A. Same sex
B. Same race
C. Birthdate within six months of peer's birthdate

Sex, race, and age have been significant variables identified in some previous studies, so an attempt was made to control for these factors.

Description of Subjects

The students who participated in the project came from first through third grade classrooms in nine elementary buildings in three suburban school districts which ranged in enrollment from 1900 to 4300 K-12 students. Eight of the schools were public, and one was parochial. Fifteen boys and ten girls made up each group. There were 6 six year olds, 15 seven year olds, 14 eight year olds, and 15 nine year olds, with the mean age being 7.8 years. Forty-nine students were Caucasian, and one female, learning disabled child was Hispanic. The Hispanic child and both of her parents were fluent in English. Both parents were professionals who have spent the majority of their lives in the United States and attended American schools. It was not possible to find a matched control for this child, so she was paired with a Caucasian female from the same school building, grade, and age group.

Socioeconomic data was not gathered or considered, because in some informal Effective Schools research conducted recently in one of the districts, three factors were identified which reduced the usual predictive value of this type of data.

A. Given the large university community, there are many temporarily poor graduate students.
B. There are many middle income automobile factory line workers with limited educational background.
C. The recent, high Michigan unemployment rate has caused large numbers of professionals and others who are typically in middle or upper income brackets, either to be unemployed or employed in lower paying positions than they usually experience.

Procedures for Selection of Subjects

After receiving district administrative approval and speaking with elementary building principals, the writer gave elementary special education teachers an outline of the project and asked them to send consent letters to the parents of all learning disabled children on their caseloads who met criteria A-F listed on page 47 (N=45). All students had been assessed by a multidisciplinary evaluation team including a school psychologist, special education teacher/consultant, and classroom teacher at a minimum. As a part of this designation as learning disabled, the assessment in all cases included the use of multiple standardized instruments and a classroom observation. Mathematical formulas were not employed as the primary basis for determining learning disability eligibility. Once the number of participating learning disabled students was known, general education teachers were to assist in sending the control children's letters.

The initial plan for selection of controls was to choose the first name following the learning disabled student's on the general education teacher's class list who met all the criteria. For a number of reasons this plan was not

manageable, and only a few consents were obtained. One participating district's research policies required that the parent consent letter had to include much more detail than the standard consent form requires. The same district did not allow researchers to ask teachers to call prospective family participants to explain the project informally before sending the letter. In order to maintain consistency in the project, comparable procedures were followed in each of the school districts. The letter may well have intimidated many parents.

Another factor was the time of year. Since the audiologist's services were not available until late May, the parents received the consent form at the same time that they were receiving many announcements of year-end activities related to graduation, parties, and so forth.

The alternative plan established to acquire the remaining control subjects included distributing a similar letter to 200 first, second, and third graders to be carried home for parent signature. This letter specified that the first consent forms received would be the ones included in the study. Twenty-six learning disabled students had signed up to participate. Twenty-seven controls signed up. One of those had a family emergency and had to be out of town during the time the audiological examinations were run. The other participated, but her data was not included in the analysis, when her matched learning disabled student failed to come to three audiological appointments scheduled for

her.

Child Development Questionnaire

The questionnaire completed by all families focused on the child's health and developmental history beginning with the mother's pregnancy. Items on the form were based primarily on a questionnaire developed by the Central Diagnostic Team of the Ingham Intermediate School District. It was modified to focus on the particular areas of concern for this study. Other resources reviewed in arriving at the current form included questionnaires used by Sparrow Hospital's Developmental Assessment Clinic and Dr. James McLoughlin. Most responses were in "yes/ no" or "mark the appropriate number" form. Much of the in- formation requested was to provide descriptive information about the participating students: control vs. learning disabled, and low incidence otitis media vs. recurrent otitis media.

The mothers' ages at time of this child's birth were recorded to provide information about high risk with mothers younger than eighteen or older than thirty-five. Similarly, pregnancy problems with the study child were reported. Birth histories were compared to the first 10 items on the following list of high risk factors for neonatal intensive care unit graduates.

1) very low birthweight (<1500g)
2) need for ventilator
3) birth asphyxia
    a)five minute Apgar of $\leq$6
    b)need for resuscitation
4) bilirubin of $\geq$20mg
5) seizures

6) intracranial hemorrhage
7) failure to regain or maintain birth weight by 21 days of age
8) sepsis/meningitis
9) intrauterine growth retardation
10) <33weeks gestation
11) high risk social status
12) team member discretion
(Mich Perinatal Association Developmental Assessment Task Force,1983)

In the Health and Medical History section of the questionnaire, frequencies of illnesses and other health problems were reported as a reliability check for other reports of otitis and allergy history. They also served as a means of sorting the severity and effects of health problems. Because the number of ear infections were reported as ranges in this study in order to accomodate reasonable limits of parent memory, exact totals could not be computed, but the criteria of at least six episodes in two years could be measured. The lower number in each range was used in summing the total number per child over the years, producing a conservative estimate of the reported incidence rate.

Family history of developmental or chronic health problems were reported, reflecting problems experienced by parents, siblings, aunts, uncles, cousins, and/or grandparents of the study child. To be counted, The problems had to be ones which began in childhood or with young adults and were chronic or recurrent in nature. They were included, because family patterns are prevalent for allergy, asthma, hearing loss, speech problems, sinus difficulties, and learning problems. The study children could be sorted according to

whether family history of these problems existed. Also, in families where a member had been identified in the past as having one of these problems, many parents become more attuned to early identification of the problem in other family members.

The General Development section of the questionnaire was included to provide further information about allergies, activity patterns, and differential rates of language vs. motor development. The mean number of speech and language delays was the focus of that section rather than any specific delay. Most of the items included here were taken from the Denver Develpmental Screening Test(DDST) with the criterion for delay being the age at which 90% of the children in the norm group showed skill mastery. A few items were selected from the Receptive-Expressive Emergent Language Scale (REEL). The items chosen were believed to be the ones parents would be most likely to remember.

The question about difficult to understand speech was included to check on several reports that articulation is often less obviously affected by recurrent otitis media than is language development. Several other questions in that section looked at parent perceptions of problems sometimes associated with otitis media: problems finding the right word or expressing their ideas clearly, complaints about noise sensitivity, or difficulty understanding or remembering directions. An estimate of parent awareness of possible hearing problems and their attempts to resolve the

issue in the past was the basis for the questions about special hearing tests beyond the regular public health school screening, and parent reported concerns about whether their child hears well.

Relative to behavior and feelings, the mean number of concerns was the focus, primarily to provide descriptive information about the control and learning disabled youngsters.

The mean number of motor development delays was compared to the number of speech and language delays to help identify differential rates of development in the otitis media group as well as with the learning disabled vs. control groups. The items were taken from the DDST with the breaking point between normal and delayed being the age at which 90% of children in the norm group had mastered the skill.

Parent assessments of their child's school performance were included to provide descriptive information about the control and learning disabled groups and to check for consistency of ratings across parent, classroom teacher, special education teacher, and student to evaluate whether these informal ratings could be considered reliable.

Another reliability check in the study was the question as to whether parents completed the questionnaire from memory alone, or whether they also referred to baby books, scrapbooks, health record booklets, and if they called their doctor's offices for verification.

Teacher Report

The release of information form obtained from each participating family allowed the school to share with the researcher:

1. The child's number of absences for each preceding year in school plus the current year's attendance to date,
2. The teacher's awareness of history of repeated middle ear problems or allergy--and if the teacher believed that either have been present, his/her belief about whether they currently affect school performance
3. The teacher's rating of the child's activity level relative to other students
4. The listing of any areas of concern identified on the most recent report card

The writer gave the teachers these forms and offered to assist in the completion of attendance data. The local special education teachers and principals in some buildings also assisted in form completion. Teacher responses to items 1-3 are covered in chapter four. The intent of the question about areas of weakness, was to have them report areas of concern great enough to warrant special notations on the formal report card. The question was open in format to allow inclusion of areas other than those in the learning disability definition and to compare with parent ratings.

Special Education Report

The families of the learning disabled students were asked for permission to allow the special education teacher to share:

1. WISC-R scores
2. A brief rating form of the teacher's impressions of the child's current performance in each area considered in the learning disability definition
3. Age when child first identified as handicapped
4. Identification of any additional special school services received

The WISC-R scores were requested, because they served as the only common, cognitive measure on file for the entire learning disabled group, and would help assess the school performance of the recurrent otitis media students relative to the group with minimal otitis media history. Also, they provided a fairly objective view of whether each student was within the normal range of intelligence. The teacher rating was an informal reliability check on school achievement relative to the ratings provided by parents, classroom teachers, and the students themselves. The age when subjects were first identified as handicapped provided an estimate of the severity of the handicapping condition, although the age would also be affected by individual parent, physician, and teacher sensitivity to developmental delays and differences, as well their feelings about what special education could offer the child. The final question was exploratory, with

the primary interest being in how many students received speech and language help, and whether significantly more of the recurrent otitis media students received that type of help than the other group.

Only twenty of the twenty-five learning disabled students had WISC-Rs on file with scores available. One girl had the WISC-R administered, but only narrative information was available, no scores. The others had been tested with the Stanford-Binet(N=2), McCarthy Scales(N=1), or Wechsler Preschool and Primary Scales(WPPSI)(N=1). One of the twenty students with a WISC-R was excluded from this analysis, because it did not seem to his parents, teachers, or this writer that the scores obtained a year ago were representative of his learning aptitude. He is a nine year old multiply handicapped child who just completed the first grade. He receives adapted physical education as well as speech and language therapy, and private psychological therapy. He takes Ritalin for Attention Deficit Disorder. Among the fifty children participating in the study he stood out as having markedly the highest activity level of all the youngsters. Both his verbal(59) and performance(61) scores were more than two standard deviations below the mean. According to most interpretations of the learning disability definition, his would not be considered a primary LD pattern. The determination to exclude this child from the WISC-R analysis was made prior to review of his middle ear history. All other students had Full Scale summary scores above 70, and

16 had Full Scales above 85.

The special educators rated each learning disabled child on each skill area identified in the federal definition of learning disabilities. They used a three point scale: 1=within normal limits, 2=slight weakness(SS 80-90), 3=significant weakness(SS<80). This system was used rather than recording specific scores on achievement tests for three reasons. First, a wide variety of tests are used for each of the key skill areas. The correlations among tests are low. Second, in a research project in the local area which concerned patterns of change in WISC-R scores, achievement tests were also reviewed. Many errors were detected in level of test administered, as well as determining raw and derived scores. Given that it was not possible in the current project to administer personally a specific achievement battery, it did not appear that scores on previously given achievement test data would be appropriate. Third, test scores are not necessarily representative of how a learning disabled child performs in the mainstream in a given content area. The appropriateness of the given instrument as well as the child's test anxiety may affect the results. Special education teachers were asked to rate the child's level of functioning considering the combination of test data and observation of daily performance.

Summary results are listed in the appendix on a special education questionnaire.

Student Reports

The final piece of data collected prior to the audiological examination was a student self-assessment of school performance completed by the learning disabled students. The child's listening and picture survey included ratings in various school subjects and two locus of control questions. The smiling/frowning face format was chosen, because it is one familiar to the students. The sample exercises on the right side of the page provided an opportunity to verify the students' understanding, and to teach the symbols if necessary. The student ratings of their academic performance could then be compared to their parents' or special education teachers' ratings. An audio tape as well as a written script for administration was prepared by the writer and the local special education consultants administered the questionnaire to their caseload students.

Fisher Auditory Problems Checklist

During the students' audiological assessment, parents completed the Fisher Auditory Problems Checklist with the writer. This list addresses parent perceptions about a child's auditory attention, comprehension, memory, speech and language, response rate, and learning motivation. This was information the audiologist needed for data analysis and provided this writer with more reliability checks on attention and speech and language to compare with responses on the Child Development Questionnaire. It also provided more descriptive data about all the subjects.

Audiological Evaluation

During the students' testing, which generally required about forty-five minutes, a licensed audiologist evaluated peripheral hearing, middle ear status, and central auditory processing. Speech reception thresholds as well as puretone air and bone conduction threshold testing were administered in a double-walled audiometric sound suite with a Grason & Stadler 1701 diagnostic audiometer at the Michigan State University audiology clinic. Frequencies tested were 250Hz, 500Hz, 1000Hz, 2000Hz, 4000Hz, and 8000Hz. Impedance audiometry using a Teledyne bridge measured middle ear pressure and compliance. Because of equipment problems, the acoustic reflex testing was unreliable and is not reported. An otoscopic examination checked ears for wax, ventilation tubes, and signs of infection or other pathology.

Finally, a Speech Perception in Noise(SPIN) test assessed the students' speech reception in the presence of controlled background noises comparable to those encountered in the school setting. After a pilot study with the five students tested the first day, the remaining students were tested at a +10dB signal to noise(S/N) ratio. Forty scores were reported and analyzed, guaranteeing equal numbers of learning disabled and control student scores and equal number of students taking form A first, form B first, competitor A first, and competitor B first. Scores were not reported for the multiply handicapped student whose WISC-R scores were excluded from the study.

Each student was administered two different fifty sentence tests, each paired with one of two competing messages and delivered monaurally to the right ear,using a JVC cassette tape player and headphones. The target sentences were presented at 60dBSL (10dB louder than the student's speech reception threshold), and the competing messages were at 50dBSL. The student was asked to repeat the last word of each target sentence presented. An Advent cassette tape player delivered competing multi-talker(8) speech in one part of the test. In the other part the competitor was noise derived from and modulated by the speech competitor, but was void of semantic content. It retained the same spectral, amplitude, and temporal characteristics as the speech stimulus. In both parts of the test, there were two types of sentences, high and low predictability. The high predictability sentences contained two or three pointer words which provided semantic links to the key word which the student had to repeat--e.g."This key won't fit in the lock." The low predictability sentences contained no pointer words--e.g."They hope he heard about the rent". Sentence length did not exceed eight syllables. The two types of sentences were intermixed in each of two forms both containing twenty-five items of each type randomly intermixed.(Elliott,1979,p.651) Prior to beginning the scored exercise, the student spent as much time as necessary to complete correctly sample items to become accustomed to the task. The order of presentation of the two forms, the two competitors, and the pairing of

competitor with list was counterbalanced.

Follow-Up Screening

American ElectroMedics Corporation made a 95-A Screening Audiometer/Tympanometer available to the writer to do follow-up screening of children who were found to have abnormal hearing or middle ear function at the time of the audiological examination. It was also available to use within the participating schools for staff inservice and to test other students following parent consent. Forty individuals were tested. Four of the study children who went to their physicians for treatment following the initial examination, were retested and found to be within normal limits on two consecutive tests at two to four week intervals. Two study children waited for the retest to consult their physician. One was within normal limits. The other had more negative pressure than during the initial testing and went to the family doctor for treatment of what was then diagnosed as an ear infection. None of these students had complained of any pain or hearing problem when they had abnormal findings.

The other people tested or their parents had concerns because of allergy problems, history of repeated otitis media, or current symptoms of ear infection. A few indicated that because of the ready availability of the equipment that they would like to have their child checked. They had no plan to go to a physician prior to the test, but when 1 of the children had abnormal findings, he was taken to the doctor and treated medically for an ear infection. Among the 25

adults tested, one had abnormal middle ear status, and five had abnormal puretone thresholds(45dB, 35dB, 55dB, 65dB, 70dB). Only the person with the 65dB loss wore amplification. The others had suspected a loss and requested the testing, but did not follow up with diagnostic testing to the writer's knowledge. Most of the inservice included helping the teachers realize what impedance test felt like and what it measured. Also, they expressed that it was helpful for them to realize the sound levels that children with conductive losses are not able to hear. As a result of the experience they expressed more concern about what they had previously considered to be negligible losses.

ANALYSIS

The findings relative to each of the nine hypotheses were prepared with technical assistance from the Statistical Package for the Social Sciences run on a Cyber 750 computer. This information is supplemented by some historical and descriptive data which helps place the findings in perspective relative to other populations.

Research Hypothesis #1: Incidence of serous and acute otitis media among learning disabled students is higher than in the non-handicapped population.

Statistical Hypothesis #1: Incidence rates of otitis media among learning disabled students are not significantly different from those found in the non-handicapped population.

Rates were compared among the learning disabled group, the control group and what is reported in the literature.

Historical Information

The number of ear infections per child which were diagnosed by doctors reveal the following frequencies.

TABLE 3

Frequency of Ear Infections

infancy:	23 none	15 1 or 2	5 3 or 4	4 5 or 6	1 >6
1-2 yrs:	22 none	11 1 or 2	10 3 or 4	6 5 or 6	1 >6
2-3 yrs:	28 none	7 1 or 2	9 3 or 4	5 5 or 6	1 >6
3-4 yrs:	28 none	14 1 or 2	5 3 or 4	3 5 or 6	0 >6
4-5 yrs:	32 none	14 1 or 2	2 3 or 4	1 5 or 6	0 >6
since 5:	31 none	13 1 or 2	5 3 or 4	1 5 or 6	0 >6

Twelve students (24% of the study population) had no reported history of any ear infections. This parallels the incidence rates reported in the literature, which indicate that 75-90% of all children experience at least one ear infection by age ten. This data also follows the pattern generally reported of peak incidence between one and three years of age. Beyond this, however, the rates in this study begin to diverge from rates reported for general pediatric populations. Thirty students (60% of the study population) experienced at least two occurrences as opposed to the 35-40% that would be expected. A liberal estimate of the percentage of children in the general population who experience a total of six or more episodes would be 15%, but with this group the mean was six infections. Ten students, or 20% of the group, experienced between six and at least eleven infections, and another eleven students(22%) reported twelve to twenty-eight infections.

For the purpose of further analysis, the group was subdivided into low and high incidence groups, with the low incidence children (n=29) reporting no more than two infections per year. This group's mean number of reported infections was 1.7 per child.

The high incidence group (n=21) included those with at least six infections during a two year period. Eleven of these received medical treatment. Ten were treated surgically as well, with the insertion of ventilating tubes and/or the removal of adenoids. The mean number of infections

for the second group was 12.6.

Another helpful way to review the data is to look at the incidence rates per group during the first year of life. The low incidence group had seven (24%) who experienced one or two infections during the first year of life. In the high incidence group, however, there was only one infant free from ear infections, eight with one infection, and ten with at least three. One family could not recall the frequency during infancy, but the child was later included in the high incidence group based on the reported health history between one and three years of age.

There is no statistically significant difference in recurrence between the learning disabled children in the study and the controls. The statistical test applied was a Chi-square at the .05 level. There were ten learning disabled and eleven control students in the high incidence group. This 40% rate in both groups exceeds the findings of the Freeman learning disability study. Even if all twenty non-participating learning disabled students notified of the study had no history of otitis media, the incidence rate for a population of forty-five learning disabled students would still exceed the norm.

Current Information

The puretone thresholds at each of seven frequencies are reported for both the better(B) and worse(W) ear of each child. The average threshold in the speech range (500Hz to 2000Hz) were computed based on those results. There were

also evaluations of the speech reception thresholds and impedance in each ear. The following table reports means in dBHL for each group--all fifty students, control vs. LD, and low vs. high incidence groups. The statistical test applied was an Analysis of Variance at the .05 level.

TABLE 4

Current Audiometric Findings

Frequency	Total Mean (dBHL)	Ctrl (25)	LD (25)	F	p	Otitis Low (29)	Otitis Recur (21)	F	p
250B	9.5	7.4	11.6	5.91	.05	9.7	9.3	0.04	NS
250W	13.6	11.8	15.4	6.03	.05	12.9	14.5	1.04	NS
500B	7.6	6.6	8.6	1.59	NS	6.2	9.5	4.50	.05
500W	12.3	11.2	13.4	2.07	NS	10.9	14.3	5.20	.05
1000B	4.9	3.4	6.4	2.34	NS	3.1	7.4	4.86	.05
1000W	8.6	7.3	9.1	1.88	NS	6.4	11.7	7.23	.01
2000B	2.8	2.4	3.2	0.60	NS	1.7	4.3	3.00	NS
2000W	7.2	7.2	7.4	0.07	NS	5.7	9.3	5.81	.05
4000B	3.5	2.6	4.4	1.04	NS	3.1	4.0	0.27	NS
4000W	8.2	7.0	9.4	1.71	NS	6.7	10.2	3.73	NS
8000B	12.9	12.0	14.0	0.87	NS	10.7	16.0	5.28	.05
8000W	17.0	17.0	17.0	0.00	NS	13.6	21.7	11.4	.005
AvThrB	5.1	4.1	6.1	1.73	NS	3.7	7.1	5.55	.05
AvThrW	9.4	8.5	10.3	1.59	NS	7.7	11.7	9.3	.005
SRTR	5.3	3.9	6.7	4.96	.05	4.9	5.9	0.54	NS
SRTL	5.8	4.2	7.4	5.60	.05	4.7	7.4	3.82	NS
ImpedR	-39.8	-25.2	-54.4	2.29	NS	-36.6	-44.3	0.15	NS
ImpedL	-48.1	-32.4	-64.4	1.16	NS	-53.4	-40.3	0.19	NS

At pure tone frequencies from 250Hz through 4000Hz and with speech reception, the learning disabled students had higher thresholds than the controls, but all of the differences were less than the 5dB step size used in the testing. Some group differences between the low incidence group and high incidence groups are statistically significant, but only at 1000Hz and 8000Hz does the difference exceed the 5dB step size. The greatest discrepancies in scores occurred at the highest frequencies rather than the expected lower frequencies. The recurrent otitis media group showed some recovery at 2000 and 4000Hz. Almost all students tested within the normal range for hearing according to the American Speech and Hearing Association standards of thresholds <25dB.

The data on average thresholds was computed by averaging the speech frequency(500Hz, 1000Hz, and 2000Hz) thresholds for each ear, except in cases where the range of the three thresholds equalled or exceeded 15dB. In those cases, a standard audio- logical procedure was employed, dropping out the highest threshold and averaging the remaining two. A test was done comparing average thresholds to speech reception thresholds. It would be expected that these would be within 10dB of each other if there was good internal test validity. Two learning disabled and no control students had $\geq$10dB discrepancies.

The speech reception thresholds were statistically different($p<.05$) between the learning disabled group and the

control group. Again, the discrepancy was less than the 5dB criterion.

The impedance data reveals six cases (12% of the study population) of active middle ear pathology. Only two right ears had negative pressure $\leq$-150mm, and five left ears met the same criteria. One child had an open ventilating tube in the left ear which negated a valid impedance reading for that ear. His right ear had significant negative pressure and a dislodged or plugged ventilating tube. The vast majority of readings were within the normal range using -150mm as the cut-off point, and there was no significant difference across groups.

As a result of participation in the study, four children were taken to their physicians for diagnosis and treatment of their middle ear status. Two had tubes inserted, and two were treated medically. None of these children had been expressing complaints about pain or poor hearing prior to the evaluation. One of the children who went on to surgery had been in the doctor's office two days prior to the audiological for a recheck on a respiratory infection, and at that time her ears looked all right, and the physician discontinued her antibiotic.

A pattern emerges indicating that relative to the means in Eagles' landmark study, members of both groups in the current study have slight conductive losses. After converting the means in Eagles's study from the ASA(1951) scale used at the time he began his study, to the ANSI(1969) scale

used currently, a series of 2-tailed T-tests were run at each frequency tested to compare his population to the students in the current study. It was assumed that Eagles' results were representative of this age population nationally, given the size and diversity of the group members and the number of recent studies citing his work as a standard.

TABLE 5

Audiometric Findings--Eagles vs. Current Population

(N=50)

Frequency	Current	Eagles	T	p
250B	9.5dB	6.0dB	3.86	.001
250W	13.6		9.88	.001
500B	7.6	8.5	-0.80	NS
500W	12.3		4.92	.001
1000B	4.9	6.3	-1.41	NS
1000W	8.6		2.23	.05
2000B	2.8	5.0	-2.96	.01
2000W	7.2		0.77	NS
4000B	3.5	3.5	0.00	NS
4000W	8.2		5.09	.001
8000B	12.9	7.0	5.00	.001
8000W	17.0		7.73	.001

(Eagles,1967,p.37)

The differences were significant for both ears at the .001 level for two frequencies, exceeding the 5dB step size at 250 and 8000Hz. Given that Eagles established his means

by using the better ear of otoscopically normal children, and the worse ear of those with problems(Eagles,1967,p.10), those are probably the only statistics powerful enough to warrant attention. Eagles' finding that differences between mean or median hearing levels of all right and left ears were less than one dB.(Eagles,1963,p.85) was not shown in the current study.

Because of the unusually high thresholds found at most frequencies, students were removed from the averaging process if they had thresholds greater than 10dB at the lower frequencies in combination with having significant negative middle ear pressure, since it is likely that a current infection or pressure problem was skewing the typical hearing threshold of those students. The following means were obtained.

TABLE 6

Adjusted Current Audiometric Findings: Excluding Students with Active Otitis

Frequency	Total Mean (N=44)	Ctrl (22)	LD (22)	F	p	Otitis Low (25)	Otitis High (19)	F	p
250B	9.1	6.6	11.3	6.46	.05	9.3	8.9	0.03	NS
250W	13.3	11.4	15.0	5.27	.05	13.0	13.9	0.30	NS
500B	7.2	6.8	8.4	1.02	NS	5.6	9.7	6.25	.05
500W	11.9	10.9	13.0	1.47	NS	10.4	14.2	5.54	.05
1000B	4.6	3.6	6.1	1.56	NS	3.0	6.9	3.73	NS
1000W	7.9	7.3	9.1	0.72	NS	5.6	11.4	8.08	.01

The adjustment changes the means slightly, but the pattern of significant differences remains essentially the same with the 1000Hz reading in the worse ear being the only one with a >5dB discrepancy between the Low and High groups. There were no such splits between the controls and learning disabled youth.

In summary, there was no significant difference between the reported incidence rates of recurrent middle ear problems between learning disabled and control children in this population lending support to the null hypothesis. The differences, however, in hearing acuity noted at several frequency thresholds between the current study population and Eagles' population, as well as the retrospective parent reports of otitis media incidence rates relative to several studies, support that the learning disabled students in the current study appear to have greater problems with otitis media than does the population in general. This supports rejection of the null hypothesis.

Research Hypothesis #2: Among learning disabled students with recurrent otitis media, defined as at least six occurrences of otitis within two years, there is a higher than average incidence of reported allergy symptoms which may continue to affect school adversely after the otitis is resolved.

Statistical Hypothesis #2: Among learning disabled students with recurrent otitis, there is no significant difference from other learning disabled students in reported incidence

of allergy problems which may affect school adversely after the otitis is resolved.

The reported incidence rates of allergy were computed for the learning disabled group, the control group, what is reported in the literature, and for children in families where one or both parents have a history of allergy.

The expected incidence rate for allergy is 15% (National Institute of Allergies and Infectious Diseases) for the general population, and approximately 60% for individuals who have one or two parents with allergy problems. In this study, that would translate to eight of the fifty students being expected to experience allergy symptoms with some not developing problems until they became young adults. Some of those eight would experience insect sting or drug allergies, hives, gastrointestinal allergy symptoms and/or eczema. These cases, unless they occurred with respiratory symptoms as well were not considered in the current study focusing on respiratory problems. Fifteen students among the fifty total were reported to have allergies, and their parents also indicated these children have experienced two or more respiratory problems frequently associated with allergies. Five control and seven learning disabled students with allergy problems also had a recurrent otitis media history. Twelve of the fifteen allergic students came from families where at least one parent had a history of respiratory allergy, and there were eleven families where at least one parent has allergies, but the study child has no allergy problems to

date. The statistical test applied was a Chi-square procedure(df=1) at the .05 level.

TABLE 7

Actual vs. Expected Allergy Incidence

	N	Actual	Expected	X^2	p
Total Group	50	15	7.5	8.82	.005
Control	25	5	3.75	0.49	NS
LD	25	10	3.75	12.26	.005
LD-Low Otitis	15	3	2.25	0.29	NS
LD-High Otitis	10	7	1.5	23.72	.005
Parent Allergy	23	12	13.8	0.59	NS

Among students reporting non-respiratory allergy symptoms, seven reported histories of hives, eczema, and in some cases GI symptoms generally associated with allergy. Those individuals would have been counted as "allergic" in the national incidence figures bringing the total to twenty-two of fifty. Again this population appears to be atypical.

In summary, among the learning disabled population, the incidence rate for allergy far exceeds the national average, particularly for those children with a history of middle ear problems. This would support the rejection of the null hypothesis.

Research Hypothesis #3: Learning disabled children with recurrent otitis media exhibit greater verbal deficits relative to their non-verbal performance than do other learning disabled children.

Statistical Hypothesis #3: Learning disabled children with a history of recurrent otitis media exhibit no significantly greater verbal deficits relative to their non-verbal performance than do other learning disabled children.

Within the LD population the profiles from the Wechsler Intelligence Scale for Children-Revised(WISC-R) were compared between the group with history of recurrent otitis media and those without that history. The following Analysis of Variance summarizes the findings. Since the sample size was too small to run a Multivariate Analysis of Variance, the test should be applied at the .01 level to reduce the probability of a Type 1 error in reviewing the five core verbal subtests.

TABLE 8

WISC-R Performance: Learning Disabled Low vs. High Incidence Otitis Media Groups

	Mean	N	Range	Low	N	High	N	F	P
Information	7.6	19	2-12	9.1	11	5.6	8	8.39	.01
Similarities	10.4	19	2-19	12.2	11	8.0	8	7.84	.05
Arithmetic	9.2	19	5-14	9.0	11	9.4	8	0.10	NS
Vocabulary	11.1	19	4-18	12.4	11	9.4	8	3.41	NS
Comprehension	10.7	19	6-15	11.7	11	9.3	8	3.56	NS
Digit Span	7.8	19	3-13	8.2	11	7.4	8	0.40	NS
Picture Comple.	10.2	19	7-16	10.7	11	9.5	8	1.44	NS
Picture Arrang.	11.1	19	4-18	11.7	11	10.1	8	1.10	NS
Block Design	10.1	19	2-13	10.6	11	9.0	8	1.86	NS
Object Assembly	10.5	18	3-17	11.0	11	9.7	7	0.76	NS
Coding	8.9	17	4-15	8.5	10	9.6	7	0.54	NS
Mazes	10.9	13	7-15	10.3	6	11.4	7	0.58	NS
Verbal	98.4		75-124	104.8		89.5		6.10	.05
Performance	102.2		67-136	103.6		100.1		0.20	NS
Perf - Verbal	9.1		-15 to 59	3.8		16.4		1.53	NS

The low incidence group had higher means than the high incidence group on the Verbal summary scale, on the Information subtest, and to a lesser extent on the Similarities subtest. The low incidence group demonstrated a greater fund of general information and stronger ability in systematic linguistic reasoning, two important skills for school success. These students also exceeded the high incidence group on the mean difference score of Performance - Verbal; however, the standard deviation there was large(22.3), and the difference did not reach the .05 level of significance.

According to a study of significant verbal/performance discrepancies for children in this age group, eight students of the nineteen had discrepancies greater than twelve points, which is significant at the .05 level when compared to the general population of six to nine year olds. Three of these students had discrepancies greater than sixteen points, which are considered to be significant at the .01 level.(Piotrowski and Grubbs,1976) The two children with the greatest discrepancies(24 and 59 points) were both members of the high incidence group.

The comparison of the profiles of the two learning disabled subgroups in this study as well as the comparison of verbal/performance discrepancy in the literature supports rejection of the null hypothesis.

Research Hypothesis #4: More learning disabled children with recurrent otitis media experience difficulty attending to

task than other learning disabled children.

Statistical Hypothesis #4: There is no significant difference in attention to task between learning disabled children with a history of otitis media and those without that health problem.

Reported concerns about student attention to task were compared across the controls and two learning disabled groups. A Chi-square(df=1) was applied at the .05 level based on teacher ratings and then separately, based on parent ratings.

Teachers reported no attention problems among the control subjects and six with the learning disabled students. Two of those students were in the low incidence group and four in the recurrent otitis group. No attention difficulties were noted for six learning disabled students who had otitis media history. A Chi-square(df=1) based on teacher ratings showed no statistically significant difference between the low and high incidence groups.

Parents of learning disabled children were more severe in their ratings of their child's attention. Parents were asked in the Child Development Form and in the Fisher Checklist about attention problems. In all twenty-five cases parents marked the same responses on both questions. When these were compared to teacher ratings, marked differences appeared. There was agreement in fourteen cases(9 no's and 5 yes'). One teacher identified a problem when a parent had not, and ten parents identified a problem when teachers had

not. Because of the varied perceptions, the Chi-square analysis of parent reports is questionable in its accuracy.

TABLE 9

Attention to Task: Parent Reports about Learning Disabled Children (N=25)

	Low Incidence OM	High Incidence OM
Attention OK	7	3
Attention Problem	8	7

There was no statistically significant difference between the two groups. It should be noted, however, that 70% of the high incidence students vs. 53% of the low incidence students were considered by their parents to have attention problems. There is not enough substantive and consistent evidence to reject the null hypothesis.

Research Hypothesis #5: A higher percentage of learning disabled children with history of recurrent otitis media experience abnormally high or low activity levels than their learning disabled peers.

Statistical Hypothesis #5: Learning disabled children with histories of recurrent otitis media experience abnormally high or low activity levels at a rate not significantly different from their learning disabled peers.

Both parents and teachers were asked to rate activity level. The groups rated the children quite differently again, making the reliability of the data questionable.

TABLE 10

Parent Report of LD Student Activity Level

	Low OM	High OM	
Normal Activity	9	2	(11)
High Activity	6	4	(10)
Low Activity	0	4	(4)

TABLE 11

Teacher Report of LD Student Activity Level

	Low OM	High OM	
Normal Activity	3	3	(6)
High Activity	5	2	(7)
Low Activity	7	5	(12)

When the two abnormal activity levels are combined to collapse the empty cell in the parent report of unusually low activity level, the null hypothesis is supported. There are no significant differences applying a Chi-square at the .05 level between the low and high incidence groups as reported by parents or teachers. Two patterns emerge, however. 1) According to parents, 40% of the low incidence group has abnormal activity levels, while 80% of the high incidence group are placed in that category. 2) There is more agreement between parent and teacher groups among the ratings for the high incidence group.

Research Hypothesis #6: Children with recurrent otitis media miss more school, hence more opportunity for instruction than most students.

Statistical Hypothesis #6: Children with recurrent otitis media miss an average number of school days per year and hence an opportunity for instruction not significantly different from others in the population.

The number of absences on file from each preceding school year and the current school year were totalled and averaged for each group, and then compared to the average number of absences per year among the total grade 1-3 population of one of the participating districts. The statistical test applied was a 2-tailed T-Test at the .05 level (df=20).

TABLE 12

Average Number of Absences per Year per Child

Group	N	#Days
Low Otitis	29	7.22
Recurrent Otitis	21	9.76
Total Group	49	8.44
District-Wide Average		6.99

The number of absences is near the district average for the low incidence otitis media group. The recurrent otitis group was statistically significantly different from the district population (T=2.23), which supports rejection of the null hypothesis.

Research Hypothesis #7: Learning disabled children with a history of recurrent otitis are more likely to perceive an external locus of control for their school progress than are

other learning disabled children of similar ages.

Statistical Hypothesis #7: Learning disabled children with a history of recurrent otitis are not likely to perceive a locus of control significantly different from other learning disabled children of similar ages.

The children's beliefs about who is responsible for their school successes and failures were reported on the "My School Work Questionnaire". Twenty-four students completed the inventory. A Chi-square test was applied(df=2) at the .05 level.

TABLE 13

Locus of Control: Learning Disabled Low vs. High Incidence Otitis Media Groups

Attribution of Success/Failure	Low	Recurrent
Child Success/Child Failure	4	1
Child Success/Adult Failure	2	2
Adult Success/Child Failure	5	4
Adult Success/Adult Failure	3	3

No statistically significant difference appeared. The most frequent rating for both groups was that adults were responsible for the students' good work, and the students themselves were responsible for their poor performance. This supports the null hypothesis. This contrasts in mood markedly from the responses about the students' perceptions of their own performance in various areas of the curriculum. The majority recorded that they were doing all right in

their work, frequently rating themselves higher than their parents, special education teachers, or classroom teachers--but possibly feeling that this progress was largely dependent on the help they received rather than their own capabilities.

Research Hypothesis #8: Most teachers working with young children suspected of being learning disabled do not routinely consider the possibility of a history of otitis media contributing to the students' learning problems.

Statistical Hypothesis #8: Most teachers responsible for working with young children suspected of being learning disabled are not aware of history of recurrent otitis media which may contribute to the students' learning problems.

The frequency with which teachers coded the same response as did the parents about the presence or absence of otitis media was compared as well as the teachers' beliefs about whether these problems affected these children's school performance.

TABLE 14

Teacher Awareness of Otitis Media Among Their Students

	Control	Learning Disabled
Actual recurrent otitis	11	10
Teachers aware of recurrent otitis	5	3
Teachers see effect of recurrent otitis	1"?"	2

Among the forty-five teachers who responded to the

question about whether they felt the student's performance might be adversely affected by recurrent otitis, the following pattern emerged. The teachers of twenty-five children agreed with parent reports and felt this health factor has not been a problem for the child. The teachers of thirteen children stated that they were not aware of the presence of the health problem, although according to parent reports, these youngsters had recurrent otitis media. In two of these cases the teachers believed that only allergies were a problem for the children. The five children reported by teachers as having many ear infections were consistent with parent reports is questionable in its accuracy. This information supports rejection of the null hypothesis.

Research Hypothesis #9: Parents of learning disabled children with a history of recurrent otitis are likely to perceive themselves or be perceived by school personnel as different in the frequency of their interaction with their child's teachers.

Statistical Hypothesis #9: Parents of learning disabled children with a history of recurrent otitis media do not perceive themselves nor are they perceived by school personnel as being significantly different in the frequency of their interaction with their child's teachers.

Parent and teacher perceptions of parent involvement in their child's school program were compared between the two learning disabled groups. As a reliability check, a Spearman Correlation Coefficient was used to compare teacher vs.

parent rating of contact frequency for all forty-three students whose teachers completed the form. Its level of significance was .002, with parent/teacher agreement occurring about half the time.

TABLE 15

Comparison of Parent and Teacher Reports of Home/School Communication Frequency

		Parent Report of Contact Frequency		
		1-3	4-6	>6
Teacher Report of Parent Contact Frequency	1-3	9	4	1
	4-6	4	7	7
	>6	2	3	6
	no report	1	2	1

Given the limited consistency among responses, the learning disabled group's were sorted by otitis incidence, but the results were not weighed heavily. The Chi-square (df=2) was not significant for parent or teacher reports which supports acceptance of the null hypothesis.

TABLE 16

Home/School Communication for Learning Disabled Population

Contacts/Yr.	Parent Report		Teacher Report	
	Low	Recurrent OM	Low	Recurrent OM
1-3	3	4	5	2
4-6	6	2	7	5
>6	6	3	3	3

This data supports the null hypothesis. There is no evidence that parents of children with histories of recurrent otitis media communicate with school with different frequency than other parents.

Speech Perception in Noise Testing

These results are part of the audiologist's research, but seemed appropriate to report here, so that the findings could be considered along with the other results. The statistical test applied was an Analysis of Variance applied at the .05 level.

TABLE 17

Speech Perception in Noise

Competitor	Predictability	Mean (N=40)	Ctrl	LD	95%Confid. Interval	F	p
Speech	High	85.6	90.6	80.6	81.9-88.9	8.65	.01
	Low	61.9	62.7	61.2	58.5-67.2	0.10	NS
Noise	High	91.0	93.5	88.4	88.7-93.3	4.38	.05
	Low	73.2	77.9	68.6	69.8-77.3	5.93	.05

Students did best on high predictability sentences with a noise competitor and worst on low predictability sentences with a speech competitor. In general, group performance improved on high predictability items during the second half of each test and became less accurate on the low predictability items. The only exception was on the noise competitor/low predictability items for the control group. The

skill in which the learning disabled students' performance was weaker than the controls' at a .01 level was perception of high predictability sentences with a speech competitor. It appears that it took the learning disabled group longer to become acclimated to that auditory environment, and that their performance became more like that of their peers as they had more practice. There was a statistically significant difference at the .05 level between the learning disabled and control students on the high and low predictability sentences with a noise competitor. In contrast, the learning disabled group performed similarly to the controls on low predictability sentences with a speech competitor. These observations are preliminary and would need to be confirmed in a future study.

Error patterns informally observed among learning disbled youngsters were substitutions of vowels, unvoiced consonants, B's and D's, M's and N's, D's and T's. These are among the more common decoding and spelling errors among learning disabled students.

SUMMARY AND CONCLUSIONS

Summary of Research Problem, Method, and Findings

The purpose of this research was to study the relationship between recurrent otitis media during early childhood and various aspects of elementary school performance by learning disabled children. Parents, general education teachers, and special education teacher/consultants provided developmental information, current performance ratings, and recent test scores. The children completed self-rating scales and received diagnostic audiological examinations.

The major findings of the study follow.

1. The incidence rates of recurrent otitis media for this population of learning disabled students were significantly higher than the rates reported in the literature.
2. Learning disabled students with recurrent otitis media had a significantly higher incidence of allergy than other learning disabled students and the control population. The other groups experienced incidence rates comparable to rates reported in the literature. Twelve students (five control and seven learning disabled) had histories of both recurrent otitis and respiratory allergy.
3. Learning disabled students with recurrent otitis media received significantly lower verbal scores on the WISC-R relative to learning disabled students with minimal otitis media history. This was particularly evident on the Information subtest. The scores on the Performance half of the test

were similar between the two groups.

4. While the learning disabled group as a whole had many more problems with attention to task than the control group, there was no significant difference in this skill between the two learning disabled subgroups.

5. No significant differences were found between the two learning disabled subgroups in frequency of abnormally high or low activity levels.

6. The learning disabled students with a recurrent history of otitis media missed significantly more school than their learning disabled peers or the general school population.

7. Learning disabled students with high and low incidence histories of otitis media responded similarly to a locus of control questionnaire. The majority saw adults as primarily responsible for their school successes (63%) and themselves responsible for their poor school performance (58%).

8. Classroom teachers were not aware of otitis history for most of the students who had recurrent episodes, and therefore did not take this information into consideration when evaluating these students' learning problems.

9. Parents of learning disabled students with high and low incidence otitis histories communicated with teachers with similar frequency.

Limitations of the Study

One limitation of the study was the small sample size. Several changes in procedure might have increased the number of participants.

1. Time of year--Select a month when fewer family social obligations would compete with the audiological appointment time.

2. Time of day--If the audiology clinic were available during school hours, the resource room groups and possibly control classrooms of participants could be provided with transportation and a classroom on campus for the day. Two students at a time could be tested while class was conducted as usual in the same building. Someone from the audiology and speech department might do a presentation to the class for one-half to one hour about hearing and language which could tie in with curriculum units on health or communication. Also, a tour of the special facilities in Michigan State University's Communication Arts building could be provided. This plan would relieve parents of time and transportation obligations, encouraging more families to participate.

3. Choice of districts--Select only districts or buildings who have investment in the project. This would facilitate positive communication and cooperation from the families.

4. Reliance on others' WISC-R testing--If a psychologist were part of the research team, WISC-Rs could be offered to families whose child had been given a different intelligence test. About fifteen students who might have participated were not asked to, because they only had McCarthy, WPPSI, or Stanford-Binet tests on file. Some of the

participants actually should not have been selected, because they did not have a WISC-R on file, but their special education teacher/consultants had not realized that when they invited the family to partipate.

The second problem with the study was the atypical control group. The group's incidence rates of otitis media were higher than average which may mean that the dichotomy between the high and low incidence groups for ratings of absences, attention, activity level, allergy, parent-school communication, and verbal-performance discrepancy may not have been as significant as it would have been with a more normal control group. A possible composite explanation of this was gathered from the writer's conversations with the fifty sets of parents at the time of the audiological exams. Many families of the learning disabled children chose to participate in the study, because they wanted to rule out the possibility of a hearing loss contributing to their child's learning problems. Among the control children, where the students were, on the whole, performing successfully in school, parents commented about this being an opportunity to find out if earlier perforations of eardrums during infections were still affecting their children's hearing, if ventilating tubes were still in place, if previous failures on school hearing tests were significant, or generally if their repeated concerns about middle ear problems could now be put to rest. A few families said that they participated because they believed that the experience would be interesting to

their children or they were doing it as a favor to the researcher. The majority, however, had concerns about repeated and/or severe ear infections. Possibly some of the procedures suggested in the previous paragraph would alleviate this problem.

A third limitation in the research was design of the questionnaires. There was much inconsistency between teacher and parent ratings of school-home communication and children's attention skills, academic skills and activity levels. More clearly structured checklists indicating frequency and severity of given behaviors would probably have reduced the inconsistency. The researchers could also administer uniform achievement tests and language tests to provide additional standardized data for analysis.

Fourth, the acoustic reflex testing was not usable because of equipment problems. This data would have been a valuable indicator of the presence of otitis media. Children who showed an absent reflex should have been rechecked on a back-up machine for confirmation. Also related to the audiological assessment, apparently there is some difficulty maintaining exact equipment calibration at 8000Hz, and testing at 6000Hz might have provided more valid data.

Fifth, the population was fairly homogeneous. Participation was on a voluntary basis by students readily available to the researcher, which makes it impossible to generalize the results beyond the participants and the limited, geographic area. All but one student was white, making it

difficult to generalize the findings to non-white students. This is significant, because the literature typically reports differential incidence rates per race. What is unclear in the literature is the different weight to be assigned to race as opposed to socioeconomic status. Although socioeconomic data was not formally gathered, there was a range. Some of the children came from families where one or both parents were professionals with one or more college degrees. Others were from families where at least one parent had a maximum educational experience of a high school diploma. Nothing is known about many of the families' economic status, and this data would have helped to determine applicability of the results to other populations.

Sixth, the audiologist knew which students were learning disabled and which were controls when he tested them. The results might have been different if he had tested blind.

Conclusions

The incidence of recurrent, early childhood otitis media and allergy are higher than average in the suburban Lansing area among white children who are identified by third grade as being learning disabled.

This learning disabled group with a history of recurrent otitis media had lower than average verbal ability as measured on the WISC-R which corresponds to difficulty with language tasks in the early elementary curriculum. Looking at the test profiles from two of the learning disabled

students excluded from the analysis in chapter four provides additional support for the discrepancy pattern. The WPPSI scores for the child in the high incidence group show the following: Information=5, Similarities=4, Verbal=67, Performance=103, Performance - Verbal=36. His performance follows the pattern observed in this study, although the data cannot be crossed statistically. The narrative information for the student in the high incidence group who took the WISC-R reported a Performance score more than two standard deviations above the Verbal score.

The Bannatyne and Kaufman Recategorization scores are often used by psychologists as another way to sort subtests to identify learning strengths and weaknesses as a baseline for developing educational plans. It would seem that their clusters which included subtests from the Verbal portion of the WISC-R might provide additional patters of difference between the low and high incidence otitis media groups. The results from this study are presented in Appendix I. These patterns can be formally tested in the future. It appears that the greatest difference between low and high incidence otitis student scores occurs on tests which assess knowledge which young children learn primarily by listening. The least difference occurs with concepts and skills that young children often learn with greater visual and tactile influence. Also, the less the students with recurrent otitis media have to describe in their own words, the closer their performance is to the low incidence students.

From observing some of the students' facial expressions during testing, it appeared that the learning disabled group encountered more unfamiliar vocabulary in the sentences than did the control group. These observations were informal and very tentative, but suggest that in a future study the students should be asked to complete some additional tasks with the SPIN material for analysis: (1) decode from print, (2) demonstrate vocabulary comprehension, and (3) spell the words missed on the listening skills tasks.

The language skill difficulty is compounded for many of these children who need as much instructional time as possible during the school day. Because of high absenteeism, they receive less instructional time than most of their classmates. Compared to their non-handicapped peers, learning disabled students as a group also make less effective use of the instructional time available because of difficulty attending to task and unusually high or low activity levels.

Many of the learning disabled youngsters have hearing which is slightly less acute than most children's. This may reduce their ability to hear correctly the instruction provided, particularly if the classroom acoustics are poor. Many of the allergic students take medications regularly, and parents reported that there seems to be a relationship between the administration of medication and the activity level and concentration skills observed.

The findings do not imply a causal link between otitis

media and school problems. The eleven control children with history of recurrent otitis media were performing satisfactorily in school according to teacher and parent reports. There is evidence in the literature that one or more biological or environmental elements common to both conditions caused or worsened the course of both the otitis media and school performance. One possibility relates to the differences in number of newborn risk factors between the control and learning disabled groups. The need for and use of certain medications, respiratory support, etc, have been linked to recurrent middle ear problems and hearing losses. A few of the learning disabled had multiple problems at birth--e.g.low gestational age, low birthweight, and need for respiratory support. The same general problem may have simultaneously affected hearing, cognition, motor skills, and so on. With a child at high risk for school problems, the history of otitis is likely to compound the degree of difficulty experienced. Support for that exists in the literature and within this study.

Another possible factor relative to the audiological findings concerns self confidence among learning disabled youth and willingness to risk responding to the audiologist before being absolutely certain of the accuracy of responses. Although the learning disabled students in this study seemed fairly positive in their self assessments on "My School Work", it would not be unusual for students with this handicap to hold back in responding to a barely audible

sound until they were clearly certain of the accuracy of their responses.

A third possible explanation for the differences between the performance of control and learning disabled students relates to the severity of the otitis media. Among the recurrent otitis media students only three of the control students had ventilating tubes inserted at some time, while seven of the learning disabled students had the surgery. This may be an indication of the physicians' beliefs that the risks of permanent hearing loss, auditory perception problems, or language difficulties outweighed the risks of general anesthesia and possible permanent tympanic membrane damage as a result of the surgical procedure.

Implications

By considering only maternal pregnancy risk factors, newborn risk factors, and history of family learning problems, seventeen of the learning disabled students could have been predicted at birth to develop learning problems, and three control students would have been incorrectly placed in the learning disabled group. By two years of age, the ability to predict or identify correctly learning disabilities in the study population would increase, particularly with respect to language development. If a child were found to be at high risk for learning disabilities, were language delayed and had recurrent otitis media at age two, it would be judicious to consider offering service to that child and his parents through special education prior to age three. It

would be wise from appropriate identification, cost of service, and treatment outcome perspectives to be more aggressive in child find activities for certain high risk children between the ages of eighteen months and three years. Also, it might be wise to include puretone audiometric and impedance testing as part of all initial preschool and early elementary referral evaluations where there is both language delay and history of otitis media. If the service were accepted, the effectiveness of early intervention could then be studied prospectively to validate the retrospective findings of this and other studies. A first step would be to assure that the parents of all referred students are at least asked if there was a history of otitis media. Finally if a student's learning is found to be impeded by a previous or continuing mild hearing loss, there would be implications for the type of intervention and the training of assigned specialists who would be most appropriate to further this child's development.

For this to occur there would need to be improved communication among parents, schools and the medical community. It would be worthwhile to help staff members understand better the history of some parents' experiences and frustrations concerning their handicapped child as well as some of the medical information. Also, increased communication between school and medical personnel could benefit some of the learning disabled children with recurrent otitis media if physicians and teachers knew specifically what kinds of

information would be beneficial to exchange and had a mutually acceptable way to exchange it.

Handicapped children often represent medical failures to the medical community, affectively although not usually in fact. This often makes it particularly difficult for some physicians to deal with referral issues. Physicians, however, would be among the most appropriate special education referral agents for most of these children. A first step could be to encourage physicians to display in their offices, brochures and posters about early identification. Specific referral criteria would need to be identified, strategies for communicating the language development concerns offered, and different service models explored to find ones acceptable to the local community which were educationally effective .

Youngsters being followed by developmental assessment clinics(DAC) following neonatal intensive care unit(NICU) hospitalization receive thorough evaluations including impedance audiometry in many clinics and developmental testing which would permit appropriate referrals if the clinics could be convinced that beneficial service would be forthcoming.

Another quality of DACs and other early identification services is that they often have the effect of increasing parent awareness of their child's developmental strengths and weaknesses and revitalize parent energy to foster the child's further development.

Early Intervention

Some commonly discussed problems with early identification of mild handicaps, in addition to poor communication between professionals involved, include questionable eligibility criteria and ways to assess them, risk to parent-child attachment, and the risk of providing a diagnosis with no follow-up service.

The most liberal special education preprimary rule comes from Maryland (Chap.22 8-401 and 8-413). Services are available to "handicapped children under the age of 6

> 1) with a physical, mental, or emotional impairment that, in the judgment of the Department, makes a special educational and training program necessary or desirable to help the child reach a scholastic achievement as near normal as feasible
> 2) includes a child who suffers from a mild, moderate, severe, or profound hearing loss"

Handicapped person is defined as

> "child who has been determined through appropriate assessment as having temporary or longterm special educational needs arising from cognitive, emotional, or physical factors,...and whose ability to meet general education objectives is impaired to a degree whereby the services available in the general education program are inadequate in preparing one to achieve his educational potential."

Maryland has a specific special education category labelled "child in need of assessment."

Frankenburg identifies eight reasons supporting early intervention.(1981,p.8)

1. Early experiences affect all areas of development.
2. Environmental experiences modify the consequences of perinatal distress.
3. There may be early critical periods for the development of certain skills.
4. Lack of early stimulation can lead to atrophy of

sensory abilities and developmental regression.
5. Failure to remediate a handicap can produce secondary deficits (emotional/social)
6. When recognition of a handicap is delayed, cognitive gaps between a delayed child and other children widen over time.
7. Parents need support and special instructions for raising a handicapped child.
8. Early intervention should be evaluated on the basis of reducing the effects of a handicapping condition, not on dramatically curing the condition.

While these were written for a broad range of handicaps, each one of them applies to children who become labelled as learning disabled who also experience early, recurrent otitis media. The dollar implication of these issues is that it costs less in the long run to begin intervention as soon as (1) an appropriate diagnosis can be made and (2) the child can benefit from a service.

The Wabash and Ohio Valley Special Education District in Illinois annually does mass screenings, which includes tympanometry of zero to five year old youngsters in their nine county area. Eight to ten percent of the children tested fail the screening and are rescreened and/or referred for medical follow-up.

A Michigan project in its early stages may help with early, more accurate prediction of mild handicaps. A statewide organization of Developmental Assessment Clinic teams are following graduates of NICUs. Uniform types of data regarding the initial hospitalization will be collected and then compared to child outcomes on standardized measures at uniform marker ages. Unfortunately, it will be several years before much school data will be available for analysis.

A practice already common in Michigan is for the local public health department to offer audiometric screenings for preschool siblings of school age children. A few weeks before the school screening is scheduled a note is sent home with the school children offering the additional service at no charge. The parent needs only to make a local phone call or return a letter to confirm an appointment. More children with mild conductive losses might be detected if the letter from the school or from the public health department recommended strongly that children with language delays (samples to be specified) and history of repeated otitis media be brought in for testing. Including tympanometry would also assist with the accuracy of preschool identification of recurrent otitis media.

Headstart is required to attempt to have 10% of its population be handicapped individuals. Developmental kindergartens also include a higher than average percentage of handicapped and academically high risk children. More aggressive otitis casefinding with this group would be likely to identify many children in need of medical treatment for and educational service related to recurrent otitis media.

In Toledo's Project CHILD, clear entrance criteria facilitate program evaluation. Children must have no evidence of sensorineural hearing loss. Their language must be at least one standard deviation below chronological age on the Sequenced Inventory of Communication Development (SICD), but other areas of development must not be more than six months

below chronological age. Clear parameters exist for audiological evidence of conductive hearing loss, middle ear fluid or abnormal middle ear pressure which must be present as well. There must be medical confirmation of treatment for serous otitis media, ruptured eardrum, chronic upper respiratory infection(URI), or allergy. Parent reports must indicate problems with draining ears, tugging at ears, earaches, chronic URI, inconsistent hearing, or other behaviors associated with otitis media.

Fifty children are enrolled. The program objectives bridge medical, developmental and educational concerns.

1. Preschool children handicapped by the effects of recurrent otitis media will demonstrate measurable improvements in speech and language skills.
2. Children with otitis media will receive appropriate medical care through community medical resources.
3. Parents of enrolled children will demonstrate understanding of their child's medical and developmental language needs by providing appropriate home language stimulation and using community medical resources.
4. An interagency agreement will provide for the continuation of medical, educational and parent training services for the target population on an interdisciplinary basis.

Following comprehensive assessment of the children's medical status and language and intellectual functioning, professionals work with the children on a language curriculum. This curriculum is shared with the parents for home reinforcement and with preschool teachers in the community to foster improved language skill development across a broader population. Parents meet in groups and have access to a toy lending library and information about otitis media and other

handicapping conditions. Bi-weekly impedance testing monitors middle ear status, and medical referrals are made as needed. Parents are encouraged to seek second opinions. A few students receive amplification. One component of their outreach efforts is that kindergarten teachers who participate in project inservices can then refer students to the project for impedance and pure tone screening.

School-Age Children

Some school age children with otitis history continue to have mild, undetected otitis media which are likely to impede their effective use of instruction. In most districts the audiological screenings available include only puretone testing and assess only three speech frequencies. Because most otitis media is treatable, it would be to the children's advantage to add impedance and acoustic reflex testing to the screening at least for those students with know otitis media history and those experiencing learning problems. Teachers should receive inservice about the diagnostic procedures and the implications of otitis media.

For school age children with history of language delay or otitis media who are referred for learning disability assessments, it should be routine procedure to include a speech and language therapist on the multidisciplinary evaluation team. A diagnostic audiological examination should be completed including central auditory processing testing. Special education teachers would need inservice on the interpretation and application of the results. Many of the

language problems detected are subtle and not obvious to those not trained to look for them, but even these minor problems can have significant impact on a child's ability to make effective use of the instruction offered in general education classes.

For any school age children with recurrent otitis media, a variety of options should be explored to improve the classroom acoustic environment and the teacher's sensitivity to problems the students were likely to experience. Some strategies commonly suggested in the literature are

1. Preferential seating: near the sound source
2. Focus child's attention before speaking
3. Use overhead projections
4. Face the student when speaking to the class
5. Avoid standing in the glare of a window
6. Speak clearly at reasonable rate without over-enunciating
7. Provide multi-sensory learning opportunities
8 Minimize the noise level in the classroom
9. Avoid a strictly phonetic approach to reading
10. Minimize extraneous motor activities during speech
11. Minimize expectations for writing while student is to be listening
12. Review known material while making transitions to new material
13. Use buddy system for extra help
14. Record instructions on tape for repeated listening
15. Use simple vocabulary
16. Use advance organizers so students know key points to listen for
17. Be positive, but realistic in grading.

Specific language remediation techniques available to

the regular classroom teacher supplement those. For example, the teacher should speak using language within the child's expressive ability to describe what the child is doing or will be asked to do. Restate the child's responses in grammatically correct form, as a reaffirmation of his or her idea rather than a correction of the grammar. Model new language structures maintaining the child's ideas, such as combining three brief sentences into one complex sentence.

In the past few years, the use of direct auditory perception training, provided in isolation from classroom contexts has been found to be of limited value. It does not appear to improve significantly a child's ability to perceive and integrate auditory stimuli.(Willeford,1978)

Occasionally low-powered hearing aids are recommended until the otitis is resolved.(Naunton,531) This is feasible only with highly motivated parents, continuing availability of an audiologist or speech therapist to monitor the equipment, and a period of diagnostic use with a loaner aid to judge its effectiveness.(Northern & Downs,1978,p.13)

FM Wireless Systems

FM wireless systems, or auditory trainers, have been used effectively for many years in oral programs for the hearing impaired to maximize students' effective use of their residual hearing. In group settings hearing aids amplify speech and background noise to a similar degree, while FM systems amplify primarily the key speech signal, improving the signal to noise (S/N) for the listener.

A unique approach to service was tried by Project MARRS (Mainstream Amplification Resource Room Study) in the Wabash and Ohio Valley Special Education District in Illinois. The two goals of the project were to determine whether students with minimal hearing loss experienced educational deficits and whether deficits could be remedied in a regular classroom program. The concerns when beginning the project were similar to those listed in chapter one of this paper. Participants were enrolled in grades 4-6, were at least 1/2 year below expectation on any part of the Wide Range Achievement Test(WRAT), and had puretone thresholds between 10dBHL and 40dBHL. Students who scored low on the Otis-Lennon Mental Abilities test were given a low priority for inclusion in the project. Seventy-nine students were eligible to participate(35.8% of 4th graders, 60.9% of 5th graders, and 75.1% of 6th graders).

Special amplification equipment was installed in the classroom of half of the target students with special loudspeakers placed in the corners of the room to adjust the S/N ratio of the entire sound field. For about three hours each day, the teacher wore a microphone connected to a wireless transmitter. The system caused the teacher's voice to sound clearer, slightly louder, and the background noise in the room to be slightly less obvious. The other half of the students received resource teacher and aide assistance with regular classroom work on a 7.5:1 ratio.

Progress was assessed annually with SRA achievement

tests over a three year period. Twenty-four students participated for the entire length of the study. The classroom amplification group demonstrated more improvement. Both teachers and students reported satisfaction with the amplification system. Listening was easier, and teachers reported less fatigue than usual. There was less frustration about students missing class instruction to receive special instruction. Teachers also became more aware of the ambient noise problem.(Sarff,1981)

Problems with the MARRS study limit its usefulness. The original concern was with learning disabled youngsters, but the criteria for subject selection included a much broader range of students than what most districts would typically call learning disabilities. Their mean scores on the SRA battery before and after the project ranged between the 41st and 50th percentiles. The student/resource teacher ratio was better than most programs can provide as well. In spite of the problems, based on the formal research and some informal replications, it seems that this method warrants further investigation.

Some preliminary research being conducted by a nationally recognized audiology researcher concerns the value of individual FM wireless systems, or auditory trainers, for students with learning disabilities or central auditory processing disorders. Based on this, Telex Corporation lent two dozen low power units to this writer for informal evaluation in elementary classrooms and during physical education. The

improved S/N ratio was similar to that found with the Phonic Ear equipment. Telex assured the writer that there was no danger of ear damage from loud noise with these low power units. Teachers wore one of two transmitters, and students were offered a variety of transducers, or listening devices which were hooked to belt-level receivers. Many were bothered somewhat by the weight and warmth of the headsets. The most satisfactory solution was a chin tube similar to those worn by secretaries when transcribing dictation. It worked best when the tube was worn behind the neck with the cords from the belt level receiver running up the back. This eliminated the problem of a few students chewing on the cords and others being generally distracted by them. The equipment was used for thirty minutes to two hours per day for three to six weeks.

There were several positive outcomes from this experience. Teachers became more sensitive to ambient noise in their classes as they took turns wearing the units themselves and heard how much difference there was in signal clarity. They mentioned less fatigue from talking loudly. One use of the equipment which was particularly helpful was to provide quiet, individual cues to the student wearing the equipment about attention to task. A teacher could circulate around the room or work with another student while continuing to give frequent feedback to the target student without being obvious to other members of the class. This strategy would not be possible with the MARRS arrangement.

Initial inservice for all school personnel involved in the project would alleviate substantially the minor concerns encountered in this informal evaluation. Most of these concerns related to equipment management, ways to optimize the effectiveness of the systems and minimize time and attention required to keep it operating correctly. The other type of concern related to optimal timing for use. For example, the system is unlikely to enhance auditory learning in group discussions, because the difficulty that the target student would experience hearing classmates clearly would counterbalance the improved signal to noise ratio the teacher's voice. Also implementing the project at the beginning of a term when classroom routines are being established and more open to change would facilitate the system's incorporation into the regular routine.

Students were enthusiastic about trying the equipment, and their classmates were given opportunities to wear a unit periodically as well. Initially it was seen as a privilege. After the first two weeks, the newness wore off, but most students were still willing to use the systems. Informal reactions by teachers were that most students who initially expressed interest in wearing the units did seem more attentive, productive, and accurate in their work while using them. The difference was slight, but a controlled study of the systems, particularly with some technical modifications Telex is considering, would be worthwhile.

Follow-Up Screening

American ElectroMedics Corporation made a 95-A Screening Audiometer/Tympanometer available to the writer to do follow-up screening of children who were found to have abnormal hearing or middle ear function at the time of the audiological examination. It was also available to use within the participating schools for staff inservice and to test other students following parent consent. Forty individuals were tested. Four of the study children who went to their physicians for treatment following the initial examination, were retested and found to be within normal limits on two consecutive tests at two to four week intervals. Two Study children waited for the retest to consult their physician. One was within normal limits. The other had more negative pressure than during the initial testing and went to the family doctor for treatment of what was then diagnosed as an ear infection. None of these students had complained of any pain or hearing problem when they had abnormal findings.

The other people tested or their parents had concerns because of allergy problems, history of repeated otitis media, or current symptoms of ear infection. A few indicated that because of the ready availability of the equipment that they would like to have their child checked. They had no plan to go to a physician prior to the test, but when one of the children had abnormal findings, he was taken to the doctor and treated medically for an ear infection. Among the twenty-five adults tested, one had abnormal middle ear

status, and five had abnormal puretone thresholds(45dB,35dB, 55dB,65dB,70dB). Only the person with the 65dB loss wore amplification. The others had suspected a loss and requested the testing, but to the writer's knowledge, they did not follow up with diagnostic testing. Most of the inservice included helping the teachers realize what impedance test felt like and what it measured. Also, they expressed that it was helpful for them to realize the sound levels that children with conductive losses are not able to hear. As a result of the experience they expressed more concern about what they had previously considered to be negligible losses. Continued availability to a school district of a screening audiometer/ Tympanometer could further the appropriate identification of individuals in need of further assessment and medical treatment as well as continue to increase teachers' understanding of the implications of slight conductive hearing losses on school performance.

Environmental Modification

Changes in the school's physical plant can provide students with recurrent otitis media a better acoustic environment for instruction with or without amplification. Walls are better than windows for reducing noise in classroom, as well as for reducing visual distractions. Landscaping around the windows which do exist reduces noise from outside the building. Carpeting in the corridors help, as well as avoidance of long, straight corridors. One of the simplest and cheapest modifications is to cover desk and chair legs in

classrooms with felt or rubber.(Bess,1981,pp.191-192)

For allergic otitis media students it would be prudent to have a physician determine the nature of the allergies and see whether minor modifications in the school environment might reduce the students' allergy symptoms or need for medication. The exclusion of plants, animals, some cleaning compounds, and perfumes combined with careful attention to dust and mold accumulation, humidity, and window opening could improve the health and learning of some of these children to a significant degree. Having enclosed bookcases, window shades instead of blinds, continuous vinyl sheet floors or low nap rugs instead of tiles and shag rugs in reading corners are examples of modifications which could help significantly with dust and mold minimization. Minor substitutions in foods served in the school cafeteria or for classroom snacks could help many students' symptoms. Attention to some details in the careful administration of medication according to directions (e.g. whether it should be taken before or after meals, with water, or not within an hour of certain foods such as milk) would enhance the effectiveness of some medications and reduce physical and behavioral side effects of others.

Summary

To maximize the learning opportunities for learning disabled children who also have a history of recurrent otitis media, some special considerations need to be made. Early, comprehensive evaluations should be encouraged.

Communication among professionals and parents should be maintained at regular intervals. Specific language enhancement and environmental modification should be incorporated into the regular classroom program to the degree manageable for the teacher and the school. Most of these changes would require continuing education for all of the professionals who work with these children.

APPENDICES

APPENDIX A

Dear Parents/Guardians:

This letter describes a research project being conducted in our school district and, with your consent, may include your child. A total of eighty 6-9 year old children in our county will participate. A description of the project follows. Additional information regarding the project, as well as a copy of all measuring instruments being used, are available in your child's school office. Please sign either the Consent to Project Participation or Refusal for Project Participation and return it to the office of your child's school. No child will participate without written parent consent, but we would appreciate having a signed refusal on record if you choose that option. If you agree to have your child participate in the research described here but later change your mind, you may withdraw your child from the project by contacting the school principal.

The project titled "School Effects of Common Early Health or Developmental Problems" is being conducted by Frances Loose and Michael Stewart. They are both completing MSU doctoral programs, Mike a licensed audiologist in the department of Audiology and Speech, Fran in the department of Counseling, Ed Psych and Special Education. Also, they both have extensive experience working in the public schools. The major project advisor is Dr. David Sciamanna, a physician specializing in neonatology & developmental medicine.

The research is being conducted between April 18, 1983, and July 29, 1983. All children participating in the project will receive a 45 minute, diagnostic audiological examination to be conducted by Mike in the MSU audiology facilities on campus. This will be done after school hours and on Saturdays during May and June. Participating families will receive an appointment card within 1 week of the time their signed consent is received. If needed, Fran can provide transportation to the appointment for children who would otherwise be unable to attend. In the audiological exam the children will wear headphones and listen and respond to a variety of pure tones and speech directions. They will also have an impedance test which measures middle ear function. A probe with a soft cuff is inserted into the ear canal. There is no discomfort involved in any of these procedures. The tests being done measure pure tone air and bone conduction thresholds, speech reception thresholds,

speech discrimination ability, tympanic membrane compliance, acoustic reflex, and central auditory processing. Results will be shared with parents in writing immediately following the testing. For those children whose initial exam is abnormal, follow-up testing can be done at the clinic and Fran has access to a screening Tympanometer/audiometer to monitor changes at 2 week intervals in the home school district. The reason for this is that many children experience mild, fluctuating hearing problems due to wax build up, infection, or fluid in the middle ear. None of the tests should be upsetting to a child. If for some reason a child were to become upset, the procedure would be terminated immediately and permanently, and the researcher's focus would shift to settling the child.

Parents will be asked to complete a child development questionnaire about their child's attainment of milestones and his or her illnesses. The report is primarily in checklist form. It will be mailed to partipating families with the audiological appointment card.

Teachers will complete a brief form recording the number of parent contacts they have had this year, a quick rating of the children's performance and activity level, and a question about whether they have been aware of any chronic health problems the children may experience. Fran will pull children's attendance history from the cumulative file. No other data will be reviewed about any of the participating children.

Resource teachers will record the initial IEPC date, other special school services received, and scores from the WISC-R. No other data will be reviewed about any of the participating children.

The research is being done to determine the local incidence of educationally significant chronic middle ear problems which may be easily screened for and often easily treated/assisted. Several groups will benefit from the research. All participating students will receive a much more comprehensive audiological evaluation than they would routinely receive through public health screening. Several major studies have reported that screening audiometry done in schools identify less than half of the hearing problems experienced by young children. The cost of an exam comparable to the one done in this study would be $40-80 per child in clinics in the Lansing area. Staff directly involved in the study will receive informal inservice on identification, significance, and types of treatment available for middle ear problems. Future students will benefit from any changes in staff awareness or district screening procedure related to this common health problem.

The information gathered will be analyzed and reported in summary form in Fran's MSU dissertation. No names of individuals or specific school districts will be reported. Mike will analyze the details of the audiological data and report that in a study of his own, again without names of specific individuals or districts. American ElectroMedics, which is lending the screening equipment, will receive the summary data mentioned above and any follow-up screening records gathered, coded by student number. Telex Communications Inc. which is providing auditory trainers for some children in the study will receive the summary data to help them assess if the equipment was helpful to the students who used it.

CONSENT TO PROJECT PARTICIPATION

I consent to the participation of _____ _____
name b.date
in the research project described above. I understand what the project involves. I also understand that I am free to withdraw from the project at any time. I understand that neither the researcher nor her approved assistants nor any other group or individual will use the material gathered in any way that would invade the privacy of this child or his/her family. I understand that the rights of this child with regard to confidentiality will be paramount.

_____ _____ _____
date parent/legal guardian signature address

To help us begin scheduling the audiological appointments, please look at the appointment times listed here and CROSS OUT any times that your child COULD NOT be available. Also, if you will be unable to bring your child to the MSU campus for the testing, please note here that Fran should contact you about arranging for a ride.

Thanks

Monday, May 23: 4-5PM 5-6PM 6-7PM 7-8PM
Tuesday, May 24: 4-5PM 5-6PM 6-7PM 7-8PM
Wednesday, May 25:4-5PM 5-6PM 6-7PM 7-8PM
Thursday, May 26: 4-5PM 5-6PM 6-7PM 7-8PM
Friday, May 27: 4-5PM 5-6PM 6-7PM 7-8PM

REFUSAL FOR PROJECT PARTICIPATION

I do not consent to the participation of _____
in any way in the research project described above.

_____ _____
date parent/legal guardian signature

APPENDIX B

May, 1983

Dear _____,

Thank you for allowing _____ to participate in the research project. His/her appointment for the audiological exam has been scheduled for _____
day date time
Please come to the Audiology and Speech Sciences Building on the southwest corner of Wilson & Red Cedar on MSU's campus. A map is provided at the bottom of this letter. If you need to change your appointment, please call me as soon as possible in the evening or on week-ends at 349-1648.

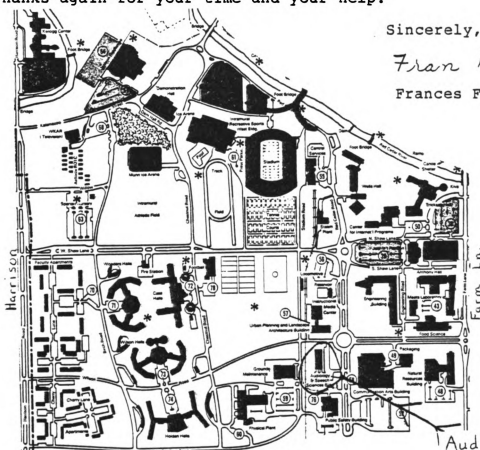
I've also enclosed the Child Development Form and a stamped, self-addressed envelope. Please return it as soon as possible. It will help us to be able to review it before your audiological appointment. As you complete the form, if you find that you just can't remember when your child mastered a skill or how often s/he had a certain health problem; mark a G by the answer that is your best Guess. Otherwise code check marks, numbers, and comments as needed.

Thanks again for your time and your help.

Sincerely,

Fran Loose

Frances F. Loose



Appendix C

CHILD DEVELOPMENT QUESTIONNAIRE

Child's name_____ Birthdate_____ Sex___

PREGNANCY/BIRTH:
Mother's age when child born: 46 18-34 yrs., (1/3)* >35 yrs
Were there difficulties with the pregnancy?43no (1/6)* yes
pre-eclampsia, Rh incompatability, attempted abortion, surgery when six weeks pregnant, migraines, C-section, induced labor, concern because of previous miscarriage and premie
Length of pregnancy:(40 wks=full term)
(0/1)* <33 wks 49 34-42 wks
Birth weight: X=7.5 lbs.
Did the baby need any special medical care at birth? 46 no
(1/3)* yes breech, doctor recommended hydrocephalus shunt, cord around neck--bluish, needed oxygen for a few hours
How long did the baby stay in the hospital?
45 less than 1 wk (0/4)* 1-4 wks (0/1)* over 1 month
During the first month of life, did the baby need treatment for any of these conditions?
breathing difficulty ___no 2 yes(describe)_____
jaundice(yellowness)requiring exchange transfusion __no__yes
infection ___no 2 yes eye, skin staph
seizures(convulsions)___no 0 yes _____
hemorrhage ___no 0 yes _____

HEALTH & MEDICAL HISTORY: Check any of these illnesses and other health problems that your child has experienced. Mark a P by any which you feel have been a major problem:

15--allergy	13--eczema/hives	14--frequent colds
4--headache	10--sinus trouble	6--draining ears
23--earaches	6--asthma	12--pneumonia
16--croup/ bronchitis	22--tonsilitis/ strep throat	9--diarrhea /stomach ache
4--food sensitiv.	(0/3)*-seizures	13--high fevers

How many ear infections did your child have diagnosed by a doctor--

as an infant	23 none	15 1-2	5 3-4	5 5-6	1 >6	1 ?
1-2 yrs of age	22 none	11 1-2	10 3-4	5 5-6	1 >6	
2-3 yrs of age	28 none	7 1-2	9 3-4	5 5-6	1 >6	
3-4 yrs of age	28 none	14 1-2	5 3-4	2 5-6	0 >6	1 ?
4-5 yrs of age	32 none	14 1-2	2 3-4	1 5-6	0 >6	
since 5th b'day	31 none	13 1-2	5 3-4	1 5-6	0 >6	

If the child is now on medication, give the name(s) and purpose: allergy shots, antibiotic, antihistamine

* (number of Controls/number of LD): reported when frequencies vary significantly between two groups

Check the types of medication that your child has taken for more than three weeks in a row.(22=none,13=one type,15=≥2)

17 antihistamine/decongestant (e.g.Dimetapp, Novahistine, Benadryl, Phenergan, Triaminic, Sudafed, Dimetane, Actifed, Ornade)
14 antibiotics(e.g.ampicillin,Amoxycillin,Gantrisin, Ilosone, Septra,Bactrim,Polymox)
3 allergy shots
5 other: Ritalin, anticonvulsants, bronchodilators, eczema cream

Has your child had problems tolerating medications, or have any seemed to affect his/her behavior? 35 no (4/11)* yes (describe): (1/7)hyperactivity or irritability, 2-sedation, 3-GI, 1-multiple

List surgery your child has had on his/her ears,nose, or throat.
age____N=9 tonsillectomy
age____N=13adenoidectomy
age____N=9 ventilating tubes
age____other enlargement sinus passage(N=1)
(34 had no surgery, 5 had one type, 11 had multiple)
(Surgery by age: 2 before 2 yrs., 4 while 2 yrs, 6 while 3, 1 each while 4,5,6, and 7)

List other hospitalizations. age____reason neurology(2), eye(3),pneumonia/bronchitis(9),hernia(2),orthopedic(4), appendicitis/gastroenteritis(2),nephrectomy(1),dehydration/ fever & vomiting(3)burns(1),swallowed object(1)

Please check the types of doctors and other professionals who have seen your child. 42 pediatrician 26 family doctor
21 ear, nose, & throat specialist 9 psychologist
6 allergist 15 audiologist(hearing tests)
11 other: urologist, orthopedist, neurosurgeon

How many times total during the past 12 months have you taken your child to appointments with these professionals?
7 none 26 1-3 13 4-6 2 7-12 0 13-24 2 25-36 0 >36

What kinds of experiences with these professionals have felt particularly helpful, negative, or a waste of time for you or your child in the past?
positive, helpful, thorough, caring, sincere, secure experience, patient, takes time to explain, listens, willing to try various management plans, good with children(16)
adequate to good--"but then I'm a very concerned parent who asks a lot of questions and demands answers(1)"
specialists particularly helpful--improvement in child's health/behavior after misdiagnosis or no improvement with primary care physician (4)
waste of time, not good with children, poor communication,

opposed to referral to specialist when appropriate, neglectful, no/inadequate follow-up, insensitive, frustrating waiting for child to "outgrow" repeated illnesses which could be treated surgically (12)
misleading statements--i.e. "Girls don't get learning disabilities." (1)

FAMILY HISTORY: Have any members of the family (father, mother, brother, sister, aunt, uncle, cousin, grandparent) experienced any of the following?

	family member(s)	age began (chi,adol)	duration	treatment required
allergy/hay fvr	23parent,11other			
asthma	5	10		
hearing impair.	9	6		
learning problem	3	10		
sinus problem	15	1		
speech problem	5	9		

GENERAL DEVELOPMENT: Eating: Breast fed? 27 Type of formula used: milk base--21, soy--2, other--1 any problems with certain foods?milk--2, common allergens--1, other--2

Sleeping: Age when began to sleep through night: X=7months, median=3.4months, mode=1month Is sleep pattern now regular? (21/14)* yes (4/11)* no (describe) 3 restless, 8 night sweats, 3 grind teeth, 2 night terrors, 1 sucks thumb

Activity Patterns:(Mark YES or NO for each) (X=3.2 areas of concern for Controls, X=5.0 for LD) underactive(1/4)* overactive(4/10)* fidgets(5/12) can't keep hands to self(3/9)* impulsive 19 stubborn 24 short attention span(3/16)* unusually alert, aware of everything25 mood swings widely 7 upset by change in routine 14 easily frustrated(6/14)* rocks body frequently, especially when younger (0/3)*

Speech and Language: (X=1.6 delays)
Noticed approaching sound 42 under 2 months 8 over 2 m.
began to laugh 43 under 3 months 7 over 3 months
understood "no, bye-bye, daddy" 38 under 7months 12 over 7m.
began to babble 42 under 9 months 8 over 9 months
spoke first word with understanding(mama,dada)
41 under 12 months 9 over 12 months
spoke 3 words other than mama or dada
37 under 15 months 13 over 15 months
followed 1 step direction to bring familiar object
44 under 18 months (1/5)* over 18 months
combined 2 words: 41 under 22 months(2/7)* over 22 months
gave first & last name:
35 under 3-1/2 yrs (4/11)* over 3-1/2 yrs
recognized 3 colors: 40 under 4 years (0/10)* over 4 years

Is speech now clearly understandable? 45 yes 5 no
(describe) multiple baby teeth missing, rapid speech, mispronounces some words, mumbles, poor grammar habits, errors on some endings, stutters when confused or rushing
Does your child often have difficulty finding the right word or expressing his/her ideas clearly? 32 no (3/15)* yes
(describe) problem carrying idea all the way through, doesn't speak in complete sentences, has to stop and think before speaking, chooses wrong words for objects or calls them things, forgets peoples' names, forgets point midway through description or explanation

Hearing: Has your child's hearing been tested other than the routine school public health screening? 30 no 20 yes
reason: routine physical, school referral, brother had hearing problem, ruptured eardrum, doctor suspected problem, enlarged adenoids, inside of ear scratched,
who tested: MSU, pediatrician, ENT, health dep't, private audiologist, military clinic when:
results: normal, different each time, slight loss, tubes needed, Sudafed
Have you often wondered if your child hears well? 28 no 22 yes
(describe) mispronounces words, reading problems, voice tone, loud speech, needs repetitions of statements, in own world, poor listening, doesn't respond to name as others in family do, wants TV loud, ruptured eardrum

Is your child easily irritated by noise? 36 no 14 yes
Does your child have difficulty understanding or remembering instructions? 31 no 19 yes

Behavior & Feelings(Mark YES or NO for each.) Always seeks company of older children 16 or younger children 10 Very dependent 20 Demands much attention 15 Shy 13 Temper tantrums(3/10)* Easily upset or frustrated 24 Generally unhappy(1/3)* Frequent crying 10 Poor self confidence(4/10)* Destroys toys or property 3 Frequently lies(2/5)*
(X=1.7 areas of concern for Controls, X=3.3 for LD)

Motor: (X=1.7 delays)
Began to sit without support 31 under 6 months 19 over 6 months
walked well 35 under 13 months 15 over 13 months
scribbled 37 under 16 months 13 over 16 months
built tower of 4 cubes 38 under 21 months 12 over 21 months
kicked ball 40 under 22 months 10 over 22 months
caught bounced ball 2 of 3 times 42 under 5 yrs 8 over 5 yrs
drew person with 6 or more body parts
33 under5-1/2 yrs (5/12)* over5-1/2 yrs

CURRENT SCHOOL LIFE: This year I sent notes, called or met with teachers (Include regularly scheduled conferences, but not routine permission slips for field trips) 1 not at all 16 1-3 times 16 4-6 times 15 more than 6 times (2--no response)

I would rate my child's current performance as follows: 1--at or above grade level, 2--some weakness, 3--having much difficulty, meeting general education expectations

	Control X	LD X	Chi Square p
oral expression	1.16	1.68	.005
listening comprehen.	1.25	1.96	.05
decoding (phonics)	1.16	2.4	.0001
reading comprehen.	1.16	2.16	.0001
spelling	1.12	1.92	.0005
writing fluency/mech	1.24	1.96	.005
math calculation	1.12	1.88	.0001
math reasoning	1.04	2.12	.0001

To complete this form I relied on 46 memory 5 call to doctor's office 7 baby book, scrapbook, or medical records booklet

If there is additional detail about your child's health and development that you feel would help explain his or her current school performance, please describe below or on the back of this sheet. Thank you for your assistance.

APPENDIX D

TEACHER REPORT

Name_____ ID: LD __ __ or Con __ __

Birthdate_____(-) Sex: __ Race: _____

number of school days missed:

1978-79:____

1979-80:____

1980-81:____

1981-82:____

1982-83:____(through ____)

Prior to this study were you aware of this student experiencing either:____chronic middle ear problems

____allergies

If you marked "yes" on either, do you feel they affected school performance?___ If so, in what way?_____

_____

This school year this child's parents have contacted me by note, phone or meeting:(Include regularly scheduled conferences, but not routine permission slips for field trips,etc)

___not at all ___1-3 times ___4-6 times ___more than 6 times

On the last report card did you indicate any areas of concern about this child's performance or progress?___
If yes, what were those areas?_____

This child's activity level in school seems:

__higher than most in class

__similar to most in class

__lower than most in class

APPENDIX E

SPECIAL EDUCATION TEACHER REPORT

Name_____ ID: LD__ __

Birthdate Date of initial IEPC_____

Has the child received special school services other than those you provide? 8 yes If yes, please list speech and language(2/4)social work(0/1)POHI(1)

WISC-R scale scores(summary means) date test given:_____

Information	7.6	Picture Completion	10.2	Verbal	98.4
Similarities	10.4	Picture Arrangement	11.1	Performance	102.2
Arithmetic	9.2	Block Design	10.1	Full Scale	99.6
Vocabulary	11.1	Object Assembly	10.5		
Comprehension	10.7	Coding	8.9		
Digit Span	7.8	Mazes	10.9		

Based on achievement tests and your observations, please rate the child's performance in the following areas:

(summary means)

oral expression	1.76*	1--at or above grade level
listening comprehen.	2.04	2--some weakness(SS 80-90)
decoding	2.04	3--having much difficulty
reading comprehen.	1.96	meeting general education
spelling	2.21	expectations(SS<80)
writing fluency/mech	2.40	
math calculation	1.68	
math reasoning	1.88	

*(1.53/2.10 means for low incidence/recurrent otitis)

APPENDIX F

MY SCHOOL WORK Script

1. Find the line with "Name" written under it.
2. Write your first and last name on the line.
3. Find the box under your name.
4. Run your finger along the top row of pictures there.
5. Now, put an X on the little stick figure in that row.
6. In the same row, put an X on the frowning face.
7. NOTE TO TEACHER: If either of these is done incorrectly, stop and explain the necessary changes. Defuse any feelings of "I'm dumb if I do it wrong" by explaining that the artist wasn't very good, and it can be hard to tell some of the pictures apart.
8. Now go to the bottom row in the box. Put an X on the big stick figure.
9. We're almost done here. Now, find the straight face, the one that isn't smiling or frowning. Put an X on that face.
10. NOTE TO TEACHER: Repeat step 7.
11. Now we're going to work on the rest of the page.
12. Go to the top where you see the word READING and then 3 faces after it. Mark the way you feel about reading on most days.If you feel that you are doing well in reading, put an X on the smiling face. If you feel that you are doing OK, but not as well as some students, mark the straight face with an X. If reading is really difficult for you, and it's hard to work on it day after day, mark the frowning face with an X. It's OK to like reading, AND it's OK to mark that it's frustrating. If you change your mind about your answer to this question or any of the others, it's OK to change your answer.
13. Go to the next line where you see the word WRITING. If you feel that you are doing well in writing letters the right size and shape and staying on the line, put an X on the smiling face. This question is not about spelling words. We'll do that separately. If you feel that you are doing OK in writing, but maybe not as well as some students, mark the straight face. If writing is really difficult for you, and it's hard to work on it day after day, mark the frowning face. Mark the way you feel about writing on most days. It's OK to like it, AND it's OK to mark that it's frustrating. If you change your mind about your answer to this question or any of the others, it's OK to change your answer.
14. Now find the SPELLING line. Mark the smiling face if you're doing well in spelling. If you're doing OK, but maybe not as well as some students, mark the straight face. If spelling is really difficult mark the frowning face. Mark the way you feel about spelling on most days.

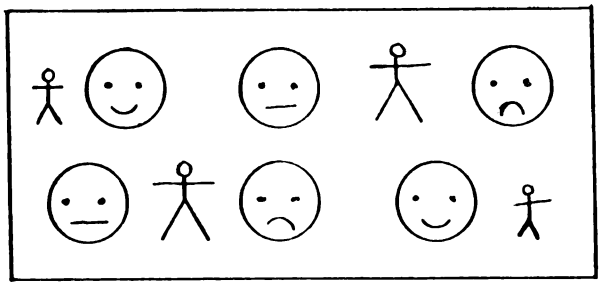
15.Find the MATH line. For your work on this page, think about math problems with just numbers, not story problems. Mark the smiling face if you're doing well in math. If you're doing OK in math, mark the straight face . If math is really difficult mark the frowning face. Mark the way you feel about math on most days.
16. Now go to the GYM line. Mark the smiling face if you're doing well in gym. If you're doing OK in gym, mark the straight face . If gym is really difficult mark the frowning face . Mark the way you feel about gym on most days.
17. One more in this section--the MUSIC line. For your work on this page, think of any time you sing or play musical instruments or listen to records with your whole class. Mark the smiling face if you're doing well in music. If you're doing OK mark the straight face . If music is really difficult mark the frowning face . It's possible that your class doesn't have any music time. If that's true, just draw a long line straight through all 3 faces. Mark the way you feel about music on most days.
18. On the bottom we're going to do something different. Think about the last couple of projects or workbook pages or tests where you did a real good job. Do you think you did the good work more because of your ability and skill or more because of the help you received from adults? If the good work was mostly because of you, put an X on the little stick figure. If you feel that the good work happened mostly because of the help you received, mark the X on the big stick figure.
19. Last question--Think about the last couple of projects or workbook pages or tests where you didn't do very well. Do you think you did the work poorly more because you couldn't do better or maybe didn't try very hard? If the work was poor mostly because of you, put an X on the little stick figure. If the problem was more because of not getting enough help from adults or if the help you received from adults wasn't clear, mark the X on the big stick figure.
20. All done. Check your page to be sure you wrote your name. Then check to see that you answered each question the way you wanted.
21. Thanks for your time and your cooperation.

My School Work

	N=16		
Reading	6	3	
Writing	18	5	2
Spelling	17	6	2
Math	15	8	2
Gym	20	4	1
Music	18	6	1

good work	9	15
bad work	14	10

Name _____



APPENDIX H

GRANT WOOD
4401 SIXTH STREET SOUTHWEST
CEDAR RAPIDS IOWA 52404

FISHER'S AUDITORY PROBLEMS CHECKLIST

Division of Special Education

Student's Name _____ District/Building _____

Date _____ Grade _____ Observer _____ Position _____

Please place a check mark before each item that is considered to be a concern by the observer:

___ 1. History of hearing loss.

___ 2. History of ear infections(s).

___ 3. Does not pay attention (listen) to instruction 50% or more of the time.

___ 4. Does not listen carefully to directions - often necessary to repeat instructions.

___ 5. Says "Huh?" and "What?" at least five or more times a day.

___ 6. Student cannot attend to auditory stimuli for more than a few seconds.

___ 7. Short attention span.

(If item is checked, also check the most appropriate time frame.)

_____ 0-2 minutes _____ 5-15 minutes

_____ 2-5 minutes _____ 15-30 minutes

___ 8. Daydreams - attention drifts - not with it at times.

___ 9. Easily distracted by background sound(s).

___ 10. Difficulty with phonics.

___ 11. Problems with sound discrimination.

___ 12. Trouble recalling a sequence student has heard.

___ 13. Forgets what is said in a few minutes.

___ 14. Does not remember simple routine things from day to day.

___ 15. Problems recalling what was heard last week, month, year.

___ 16. Difficulty following auditory directions.

___ 17. Often misunderstands what is said.

___ 18. Does not comprehend many words - verbal concepts for age/grade-level.

___ 19. Slow or delayed response to verbal stimuli.

___ 20. Has a language problem (morphology, syntax, vocabulary, phonology).

___ 21. Has an articulation (phonology) problem.

___ 22. Child cannot always relate what is heard with what is seen.

___ 23. Learns poorly through the auditory channel.

___ 24. Lacks motivation to learn.

___ 25. Performance is below average in one or more subject area(s).

Scoring: Four percent credit for each numbered item **not** checked.

Number of items **not** checked _____ x 4 = _____

See Reverse Side for Normative Data

Appendix I

Bannatyne and Kaufman WISC-R Recategorization Scores

Bannatyne

Conceptual	Acquired Knowledge
Comprehension	Information
Similarities	Vocabulary
Vocabulary	Arithmetic

Kaufman

Verbal Comprehension	Freedom from Distractibility
Information	Arithmetic
Similarities	Digit Span
Vocabulary	Coding
Comprehension	

Much Expression Required	Little Expression Required	Left Brain
Similarities	Information	Vocabulary
Vocabulary	Arithmetic	Similarities
Comprehension	Digit Span	

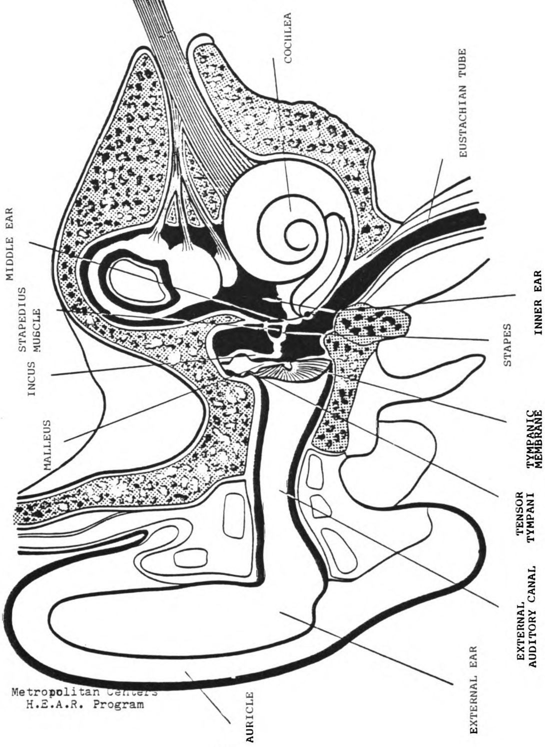
The following scores are sequenced according to the F score which reflects the difference in scores between the low and high incidence groups. The Conceptual cluster is identical to the Much Expression Required cluster and is not reported separately.

TABLE 18

Bannatyne and Kaufman WISC-R Recategorization Scores

	Mean	N	Range	Low	N	High	N	F	p
Verbal Comp.	39.8	19	20-62	45.4	11	32.3	8	7.39	.05
Left Brain	21.5	19	9-35	24.5	11	17.4	8	6.30	.05
Much Express.	32.2	19	16-50	36.3	11	26.6	8	6.06	.05
Brief Stimuli	29.4	19	14-47	32.7	11	24.8	8	5.45	.05
Recall	26.6	19	13-40	29.6	11	22.4	8	5.43	.05
Reasoning	30.3	19	19-42	32.9	11	26.6	8	4.82	.05
Acquired Knowl.	27.9	19	16-40	30.5	11	24.4	8	4.56	.05
Long Stimuli	27.5	19	18-37	29.8	11	24.3	8	4.52	.05
Little Express.	24.6	19	13-33	26.3	11	22.4	8	2.44	NS
Free.Distract	26.5	17	14-40	26.0	10	27.3	7	0.15	NS

APPENDIX J



Metropolitan Centers
H.E.A.R. Program

APPENDIX K

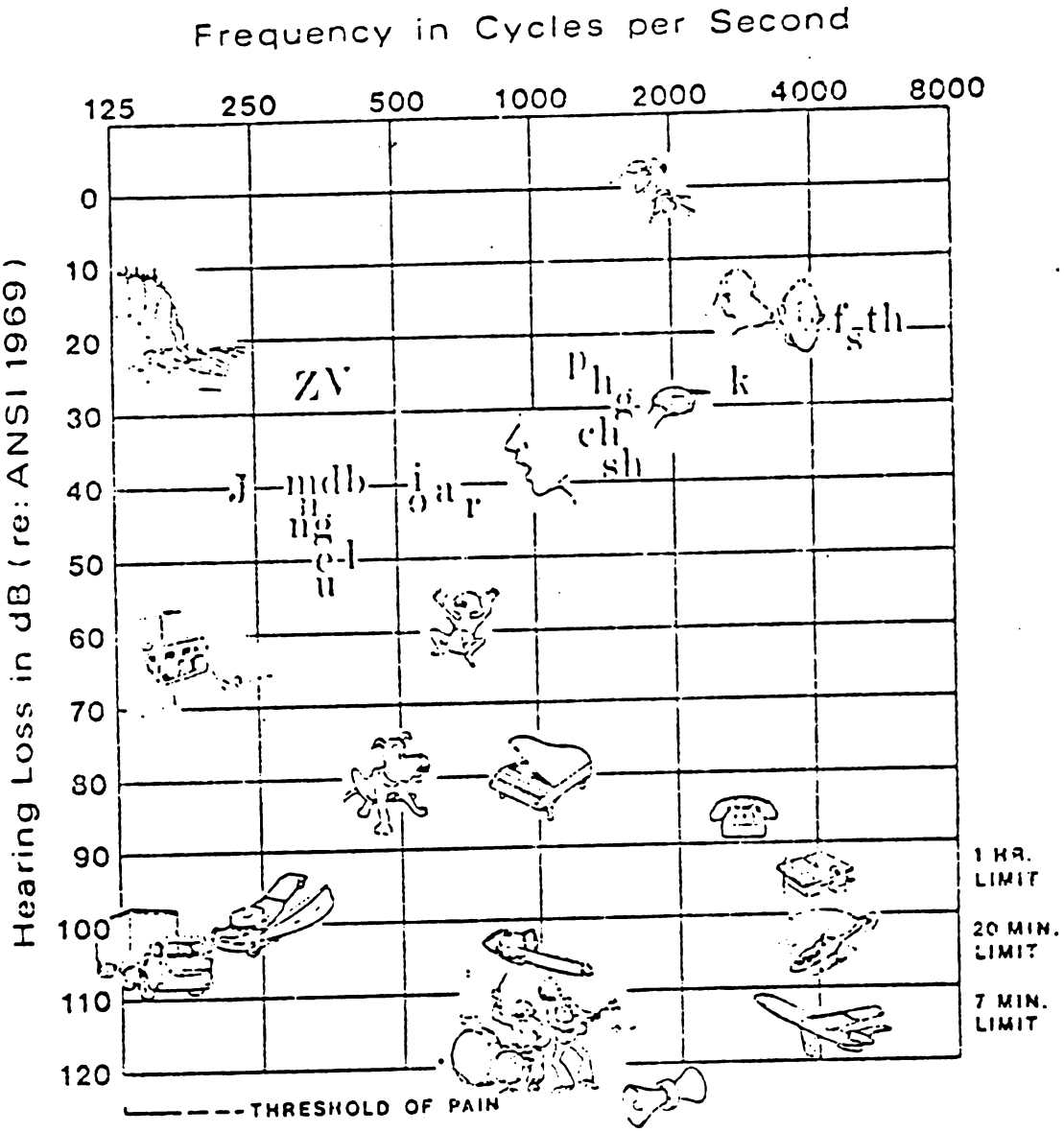


Fig. 1.11. Frequency spectrum of familiar sources.

from Northern and Downs, Hearing in Children, 2nd ed.

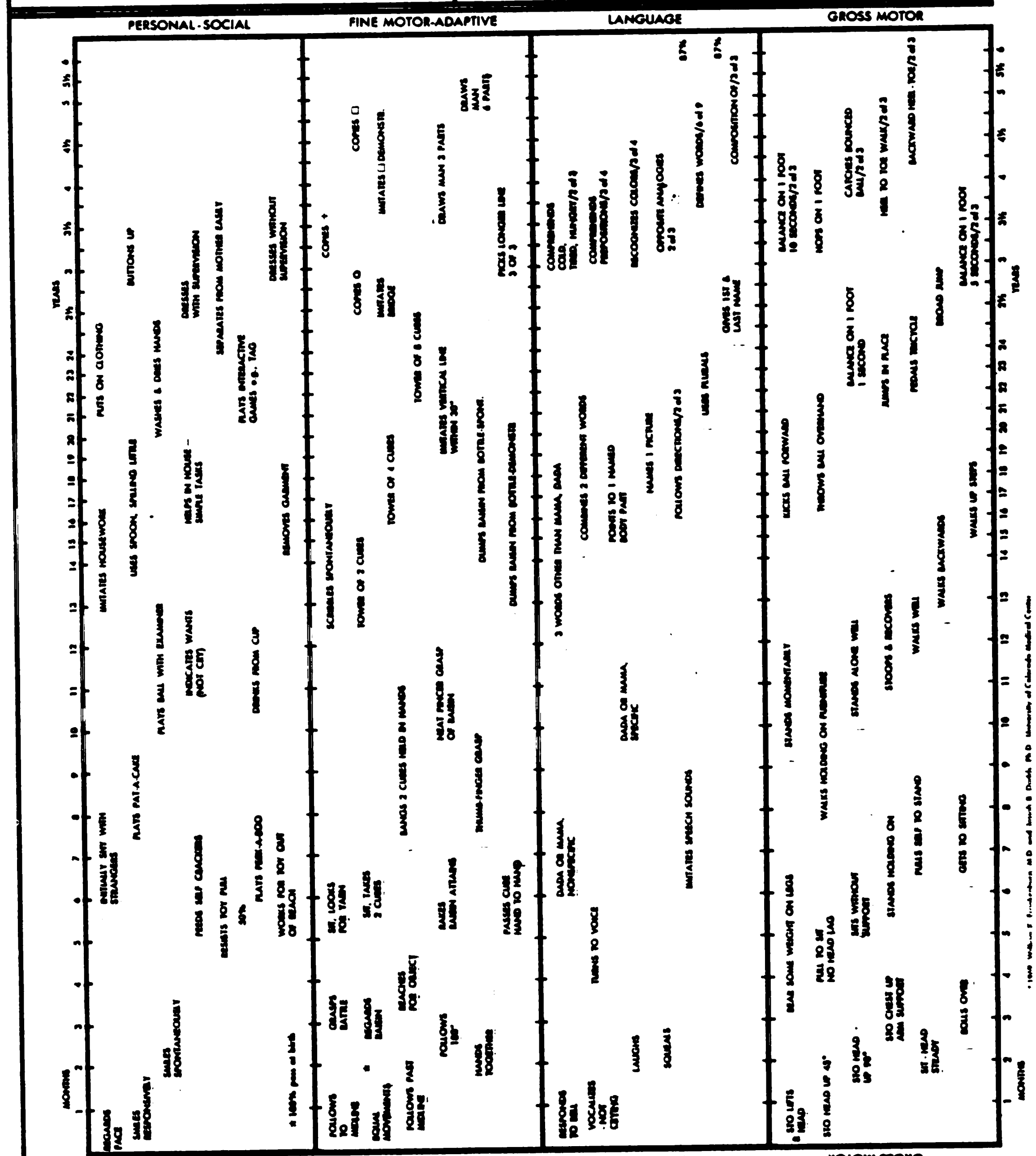
DENVER DEVELOPMENTAL SCREENING TEST

STO.=STOMACH
SIT=SITTING

PERCENT OF CHILDREN PASSING
25 50 75 90
May pass by report
Footnote No. - see back of form
Test Item

Date
Name
Birthdate
Hosp. No.

APPENDIX L



APPENDIX M

OTHER PREPRIMARY TESTS

Bayley Scales of Infant Development(0-30 months)
Psychological Corporation
757 3rd Avenue
New York, NY 10017
A. Mental Scale
B. Motor Scale

Boehm Test of Basic Concepts
Psychological Corporation
757 3rd Avenue
New York, NY 10017

Brigance Inventory of Early Development(0-7 years)
Curriculum Associates, Inc.
5 Esquire Road
North Billerica, MA 01862-2589
A. Pre-Ambulatory Motor Skills and Behaviors
B. Gross Motor Skills and Behaviors
C. Fine Motor Skills and Behaviors
D. Self Help Skills
E. Pre-Speech
F. Speech and Language Skills
G. General Knowledge and Comprehension
H. Readiness
I. Basic Reading Skills
J. Manuscript Writing
K. Math

Carolina Developmental Profile(2-5 years)
Kaplan Press
600 Jonestown Road
Winston-Salem, NC 27103
A. Gross Motor
B. Fine Motor
C. Visual Perception
D. Reasoning
E. Receptive Language
F. Expressive Language
G. Social Emotional

Colorado Sound Screener(2-6 years)
Colorado Dep't. of Public Health
Hearing and Speech Services
4210 East 11th Ave.
Denver, CO 80220
Attn: Harold J. Weber

Developmental Indicators for Assessment of Learning
DIAL, INC.
Box 911
Highland Park, IL 60035

Goldman-Fristoe-Woodcock Auditory Skills Test Battery(>3yrs)
American Guidance Service
Publishers' Building
Circle Pines, MN 55014

A. Selective Attention
B. Diagnostic Discrimination
C. Auditory Memory (Recognition, Content, Sequence)
D. Sound-Symbol (Mimicry,Recognition, Analysis, Blending, Association, Reading, Spelling)

Hawaii Early Learning Profile (0-12+ years)
VORT Corporation
PO Box 11757
Palo Alto, CA 94306

A. Cognitive
B. Language
C. Gross Motor
D. Fine Motor
E. Social-Emotional
F. Self Help

Kaufman Assessment Battery for Children (2-6 to 12-6 years)
American Guidance Service
Publishers' Building
Circle Pines, MN 55014

A. Sequential Processing
B. Simultaneous Processing
C. Achievement
D. Mental Processing Composite

Learning Accomplishment Profile (0-6 years)
Kaplan Press
600 Jonestown Road
Winston-Salem, NC 27103

A. Fine Motor
B. Social Skills
C. Self-Help
D. Cognitive
E. Language Development

Miller Assessment for Preschoolers (2-9 to 5-8 years)
KID Technology
11715 E. 51st Ave.
Denver, CO 80239
A. Foundations
B. Coordination
C. Verbal
D. Non-Verbal
E. Complex Tasks

Peabody Picture Vocabulary Test (>2-6 years)
American Guidance Service
Publishers' Building
Circle Pines, MN 55014

Pediatric Examination of Educational Readiness
Educators Publishing Service, Inc.
75 Moulton St.
Cambridge, MA 02238-9101
A. Orientation
B. Gross Motor
C. Visual-Fine Motor
D. Sequential
E. Linguistic
F. Preacademic Learning

Preschool Attainment Record (0-7 years)
American Guidance Service
Publishers' Building
Circle Pines, MN 55014
A. Physical (Ambulation, Manipulation)
B. Social (Rapport, Communication, Responsibility)
C. Intellectual (Information, Ideation, Creativity)

Pre-Speech Screening Questionnaire (3-12 months)
Suzanne Evans Morris, Ph.D.
202 Shepard Terrace
Madison, WI 53705
A. Feeding
B. Early Sound Production

Receptive-Expressive Emergent Language Scale (0-3 years)
University Park Press
300 N. Charles Street
Baltimore, MD 21201

Sequenced Inventory of Communication Development(4-48months)
University of Washington Press
Seattle, WA 98105
A. Receptive (Awareness, Discrimination, Understanding)
B. Expressive(Imitate,Initiate,Response, Verbal Output)

Test of Language Develoment--Primary (4-0 to 8-11)
Pro-Ed
5341 Industrial Oaks Blvd.
Austin, TX 78735

A. Grammatic Understanding
B. Sentence Imitation
C. Grammatic Completion
D. Word Articulation
E. Word Discrimination
F. Picture Vocabulary
G. Oral Vocabulary

APPENDIX N

MODEL PROGRAMS

American Association of University Affiliated Programs for the Developmentally Disabled
1234 Mass. Ave., N.W., Suite 813
Washington, D.C. 20005
Community Workbook for the Collaborative Services to Preschool Handicapped Children

Boys Town Institute for Communication disorders in Children
Omaha, NB
Comprehensive multidisciplinary evaluations and remediation

Child Development Unit, Ambulatory Care Center
Children's Hospital of Pittsburgh
125 DeSoto Street
Pittsburgh, PA 15213
Multidisciplinary diagnostic, consultative, and therapeutic services for children (0-18) with developmental problems
Parent education courses

Center for the Study of Families and Children
Institute for Public Policy Studies
Vanderbilt University
1208 18th Avenue South
Nashville, TN 37212
Public Policies Afecting Chronically Ill Children and Their Families

Developmental Evaluation Services for Children (DESC)
2000 Dennis Avenue
Silver Springs, MD 20902
Interagency, interdisciplinary identification and assessment of developmentally delayed preschoolers
4 visits to 4-6 week placement in diagnostic nursery

Elks Purple Cross Deaf Detection and Development Program
4908 Dewdney Avenue
Regina, Saskatchewan S4t 1B8

Preschool Program
Board of Cooperative Educational Services
Yorktown Heights, NY 10598
Transdisciplinary training, assessment, and consultation model
Parent Activity Catalog

Project C.H.I.L.D.(Conductive Hearing Impairment/Language Development)
Toledo Public Schools
1624 Tracy Street
Toledo, Ohio 43605
- Improving Your Child's Listening and Language Skills: A Parent's Guide to Language Development
- Instructional Curriculum
- Consultation Guidelines

Project TAP (Tapping Achievement Potential, Tapping Adult Potential, Teenage Awareness Program)
PO Box 19643
Department of Education
North Carolina Central University
Durham, NC 27707
- Nursery School--developmentally delayed and others integrated
- Parent education component
- Teen training in child development and handicaps

Project WELCOME
333 Longwood Avenue
Boston, MA 02115
- Family support program
- Transition program linking NICU families to needed services
- Outreach training for health care providers about needs of high risk infants

WESTAR (Western States Technical Assistance Resource)
University District Building
1107 N.E. 45th, Suite 915
Seattle, WA 98105
- Distribute materials relative to effecxtive early intervention

APPENDIX O

RESOURCE ORGANIZATIONS

American Speech-Language-Hearing Association
10801 Rockville Pike
Rockville, MD 20852

Association for Children & Adults with Learning Disabilities
4156 Library Road
Pittsburgh, PA 15234

Asthma and Allergy Foundation of America
19 West 44th Street
New York, NY 10036

Council for Exceptional Children
Division of Early Childhood
1920 Association Drive
Reston, VA 22091

Council for Learning Disabilities
c/o Gaye McNutt
College of Education
University of Oklahoma
Norman, OK 73019

Handicapped Children's Early Education Program
Department of Education
400 Maryland Avenue, SW
Donohoe Building, Room 4046C
Washington, D.C. 20202

National Association for Hearing and Speech Action
10801 Rockville Pike
Rockville, MD 20852

Project FIND
Michigan Department of Education
Special Education Services
Box 30008
Lansing, MI 48909

BIBLIOGRAPHY

BIBLIOGRAPHY

Ack,M., Andrews, P., Levine, M., & Prugh, D. "When the Child is Learning Disabled,"Patient Care,1982,16,6,18-57.

Agar,M. The Professional Stranger: An Informal Introduction to Ethnography. New York: Academic Press, 1980.

American Academy of Pediatrics. "Recommendations to Improve Physicians' Role in Planning Educational Programs for Children with Handicaps". 1983 study summarized on SpecialNet.

Bachrach,R., Huesmann,L., & Peterson,R. "The Relationship Between Locus of Control and the Development of Moral Judgment." Child Development, 1977,48,1340-1352.

Batshaw, M.L. & Perret, Y.M. Children with Handicaps: A Medical Primer. Baltimore: Paul H. Brookes, 1981.

Battin, R.R. "Developmental Effects of Early Middle Ear Disorders," in THE Journal, 1982,4,(1),31-32.

Bess,F.H. & McConnell,F.E. Audiology, Education, and the Hearing Impaired Child. St. Louis: C.V. Mosby,1981.

Bierman,C.W. & Pearlman,D.S. Allergic Diseases of Infancy, Childhood, and Adolescence. Philadelphia: W.B.Saunders, 1980.

Blanton,J. & Katt,D. "Some Indications of Racial (Black-White) Bias in Young Children's Tympanometric Results," Michigan Speech and Hearing Journal,1982,18,11-16.

Bluestone,C. "Otitis Media in Children: To Treat or not to Treat". New England Journal of Medicine. 1982,306,23, 1398-1404.

Bluestone,C.D., & Cantekin,E.I. "Design Factors in the Characterization and Identification of Otitis Media and Certain Related Conditions," in Hanson,D. & Ulvestad,R. (Ed.) Otitis Media and Child Development: Speech, Language, and Education. papers from a 1979 workshop sponsored by the Communicative Disorders Program of the National Institute of Neurological and Communicative Disorders and Stroke.

Bluestone,C. et.al. "Effects of Otitis Media on the Child, Pediatrics, 1983,71,(4),639-652.

Brazleton,T.B. Infants and Mothers: Differences in Development. New York: Delacorte Press, 1969.

Brooks,D.N. "Design Factors in the Identification and Assessment of Hearing Loss," in Hanson,D. & Ulvestad,R. (Ed.) Otitis Media and Child Development: Speech, Language, and Education. papers from a 1979 workshop sponsored by the Communicative Disorders Program of the National Institute of Neurological and Communicative Disorders and Stroke.

Brooks,D. "Impedance Screening for School Children: State of the Art", in Harford,E., et.al. Impedance Screening for Middle Ear Disease in Children. New York: Grune and Stratton,1978.

Bush,W.J. & Waugh,K.W. Diagnosing Learning Problems. (3rd ed.) Columbus: Charles E. Merrill,1982.

Byrne,M. "The Role of the Speech-Language Pathologist and Audiologist in Learning Disabilities", a memo to the field from the President of the American Speech and Hearing Association, January, 21, 1980.

Cantekin,E. et.al. "Lack of Efficacy of a Decongestant/Antihistamine Combination for Otitis Media with Effusion in Children", New England Journal of Medicine, February 10,1983,308,297-301.

Clark,J.G. Audiology for the School Speech Language Clinician. Springfield: Charles C. Thomas, 1980.

Davis,H. & Silverman,S.R. Hearing and Deafness. (4th ed.) New York: Holt, Rinehart and Winston, 1978.

Dickie,D, Johnson,W. & Stewart,M. Ingham Intermediate School District Memo Re:Preschool Audiological Assessment Results,December 4,1981.

Dobie,R.A. & Berlin,C.I. "Influence of Otitis Media on Hearing and Development," in Hanson,D. & Ulvestad,R. (Ed.) Otitis Media and Child Development: Speech, Language, and Education papers from a 1979 workshop sponsored by the Communicative Disorders Program of the National Institute of Neurological and Communicative Disorders and Stroke.

Dockhorn,R.J. "Otolaryngologic Allergy in Children", in Jazbi,B. (Ed.) Symposium of Pediatric Otorhinolaryngology. Vol. 10,1. Philadelphia: W. B. Saunders,1977.

Downs, M. & Blager, F. "The Otitis Prone Child", in Developmental and Behavioral Pediatrics. 1983,3,(2),106-113.

Duane,D. "Neurologic and Linguistic Aspects of Written Language". paper presented at the meeting of the American Speech and Hearing Association, Toronto, November,1982.

Dudley-Marling,C., Snider,V., & Tarver,S. "Locus of Control and Learning Disabilities: A Review and Discussion", Perceptual & Motor Skills,1982,54(2),503-14.

Eagles,E.L., Wishik,S.M., & Doerfler,L. Hearing Sensitivity and Ear Disease in Children: A Prospective Study. St. Louis: The Laryngoscope,1967.

Eagles,E.L., Wishik,S.M., & Doerfler,L. Hearing Sensitivity and Related Factors in Children. St. Louis: The Laryngoscope, 1963.

Elliott,L.L. "Effects of Noise on Perception of Speech by Children and Certain Handicapped Individuals". Sound and Vibration, December,1982,10-14.

Elliott, L.L. "Performance of Children Aged 9 to 17 Years on a Test of Speech Intelligibility in Noise Using Sentence Material with Controlled Word Predictability." Journal of the Acoustical Society of America, 1979, 66(3),651-653.

Featherstone,H. A Difference in the Family. New York: Basic Books,1980.

Fraiberg,S. Every Child's Birthright: In Defense of Mothering New York: Basic Books, 1977.

Frankenburg,W.K. (Ed.) Pediatric Developmental Diagnosis. New York: Thieme-Stratton,1981.

Freeman,B.A. & Parkins,C. "The Prevalence of Middle Ear Disease among Learning Impaired Children." Clinical Pediatrics 1979,18,(4),205-211.

Gerwin,K. & Glorig,A. Detection of Hearing Loss and Ear Disease in Children. Springfield: Charles C. Thomas,1974.

Ghory,J.E. "OME: Leading Cause of Preventable Hearing Loss" The Journal of Respiratory Diseases, October, 1982.

Giannini,A.V., Schultz,N.D., Chang,T.T., & Wong,D.C. The Best Guide to Allergy. New York: Appleton-Century-Crofts, 1981.

Gilkerson,L. & Topjian,C. "Follow-Up of Children from ICU to Community--Project Welcome" paper presented at the meeting of the Handicapped Children's Early Education Project, Washington, D.C., December,1982.

Glorig,A. & Gerwin,K.S. (Ed.) Otitis Media: Proceedings of the National Conference, Callier Hearing and Speech Center, Dallas. Springfield: Charles C. Thomas, 1972.

Goetzinger,C. "Psychological Aspects of Early Deafness," in Jazbi,B., (Ed.) Pediatric Otorhinolaryngology. New York: Appleton-Century-Crofts,1980.

Gordon,D., Jones,R., & Short,N. "Task Persistence and Locus of Control in Elementary School Children". Child Development,1977,(48),1716-1719.

Holm,V. & Kunze,L. "Effects of Chronic Otitis Media on Language and Speech Development". Pediatrics, 1969,43, 833-838.

Holroyd,J. "Questionnaire of Resources and Stress: An Instrument to Measure Family Response.

Ingham Intermediate School District. "Central Diagnostic Team Intake History", 1980.

Jazbi,B.(Ed.) Pediatric Otorhinolaryngology: Proceedings of the Second International Symposium on Pediatric Otorhinolaryngology, Kansas. Amsterdam: Excerpta Medica,1979.

Jerger,J. (Ed.) Handbook of Clinical Impedance Audiometry. Acton: American Electromedics Corporation, 1975.

Johnson,S. & Morasky,R. "Communication of Diagnostic/Prescriptive Information, in Learning Disabilities. Boston: Allyn and Bacon,1980.

Kalikow,D.N. & Stevens,K.N. "Development of a Test of Speech Intelligibility in Noise Using Sentence Materials with Controlled Word Predictability". Journal of the Acoustical Society of America, 1977,61,5.

Katz,J. "The Effects of Conductive Hearing Loss on Auditory Function". American Speech and Hearing Association Journal, October, 1978, 879-886.

Katz,J. (Ed.) Handbook of Clinical Audiology (2nd ed.) Baltimore: Williams & Wilkins, 1978.

Klaus,M. Maternal-Infant Bonding. St. Louis: C.V.Mosby,1976.

Klaus,M. & Fanaroff,A.A. Care of the High-Risk Neonate. (2nd ed.) Philadelphia: W.B. Saunders,1978.

Korones,S.B. High Risk Newborn Infants: The Basis for Intensive Nursing Care. St. Louis: C.V. Mosby,1976.

Kramer,R. "Otorhinolaryngology in Pediatric Practice" in Jazbi,B. (Ed.) Pediatric Otorhinolaryngology. New York: Appleton-Century-Crofts,1980.

Lawrence,E. & Winschel. "Locus of Control: Implications for Special Education". Exceptional Children, April, 1975, 483-490.

Lerner,J. & Cohn,S. "Learning Disabilities and the Childcare Physician", in Cruickshank,W. & Silver,A.Bridges to Tomorrow,Vol.2. Syracuse: Syracuse University Press,1981.

Lindsay,G.A. & Wedell,K. "The Early Identification of Educationally 'At Risk' Children Revisited," Journal of Learning Disabilities, 1982,15,4, 212-217.

Martin,F.N. (Ed.) Pediatric Audiology. Englewood Cliffs: Prentice-Hall,1978.

McCarthy,J. "Specific Content Category Needs of Young Language Impaired Children". paper presented at the meeting of the Association of Children with Learning Disabilities, Washington, D.C., February, 1983.

McDermott,J. "Physical and Behavioral Aspects of Middle Ear Disease in School Children," Journal of School Health. 1983,53(8)463-466.

McLoughlin,J. et.al. "The Relationship of Allergies and Allergy Treatment to School Performance and School Behavior". Annals of Allergy, 1983, in press.

McLoughlin,J. & Nall,M. "Allergies and Learning Disabilities Fact and Fiction". paper presented at the International Conference on Learning Disabilities, Kansas City, October,1982.

Mencher,G.T. & Gerber,S.E. (Ed.) Early Management of Hearing Loss: Proceeding of the Winnipeg Conference. New York: Grune & Stratton,1981.

Michigan Special Education Rules, Michigan State Board of Education, Lansing, August, 1980.

Miller,S. Living With Martin videotapes. Michigan State University, 1980.

Mills,A. A Doctor Discusses Allergy: Fact and Fiction. Chicago: Budlong Press Company, 1979.

Murray,J.N. & Cornell,C.J. "Parentalplegia". Psychology in the Schools. 1981,18,201-207.

Naremore,R.C. "Influences of Hearing Impairment on Early Language Development," in Hanson,D. & Ulvestad,R. (Ed.) Otitis Media and Child Development: Speech, Language, and Education. papers from a 1979 workshop sponsored by the Communicative Disorders Program of the National Institute of Neurological and Communicative Disorders and Stroke.

Naunton,R.F. "Deafness in Early Childhood," in Jazbi,B. (Ed.) Pediatric Otorhinolaryngology. New York: Appleton-Century-Crofts, 1980.

Naunton,R.F. "Panel on Experiences with Middle Ear Ventilating Tubes," Annals Otology, Rhinology, and Laryngology 1981,90,529-532.

Nelson,H.S. "The Clinical Relevance of IgE". Annals of Allergy,August,1982,49,73-80.

Northern,J.L., et.al. "A Technique for Identifying Ear Disease in Children". American Electromedics Corporation.

Northern,J.L. (Ed.) Hearing Disorders. Boston: Little, Brown and Company,1976.

Northern,J.L. & Downs,M.P. Hearing in Children, (2nd ed.) Baltimore: Williams & Wilkins,1978.

Ohio State University, College of Medicine. Abstracts of the Third International Symposium: Recent Advances in Otitis Media With Effusion, Fort Lauderdale, May, 1983.

Onion,D.K. & Taylor,C. "The Epidemiology of Recurrent Otitis Media". American Journal of Public Health1977,67,472-74

Paradise,J.L. "Otitis Media During Early Life: How Hazardous to Development? A Critical Review of the Evidence". Pediatrics, 1981,68,869-873.

Paradise,J.L. "Otitis Media in Infants and Children". Pediatrics, 1980,65,5,917-943.

Pearl,R. & Bryan,T. "Mothers' Attributions for their Learning Disabled Child's Successes and Failures". Learning Disability Quarterly. Winter,1982,5,53-57.

Piotrowski,R.J. & Grubb,R.D. "Significant Subtest Score Differences on the WISC-R." Journal of School Psychology, 1976,14,3.

Powell,M. Assessment and Management of Developmental Changes and Problems in Children. St.Louis: C.V.Mosby,1981.

Project C.H.I.L.D. Performance Report--First Year (Toledo Public Schools Project G00-8000197), September, 1981.

Rapin,I. "Conductive Hearing Loss: Effects on Children's Language and Scholastic Skills" in Hanson,D. & Ulvestad R. (Ed.) Otitis Media and Child Development: Speech, Language, and Education papers from a 1979 workshop sponsored by the Communicative Disorders Program of the National Institute of Neurological and Communicative Disorders and Stroke.

Reichman,J. & Healey,W. "Learning Disabilities and Conductive Hearing Loss Involving Otitis Media." Journal of Learning Disabilities. May,1983,16,5,272-278.

Rintelmann,W.F. (Ed.) Hearing Assessment. Baltimore: University Park Press,1979.

Roach,B. et.al. "Influence of Age and Sex on Serum Complement Components in Children". American Journal of Diseases in Children. October,1981,135,918-920.

Roeser,R.J. et.al. "Comparison of Tympanometry and Otoscopy in Establishing Pass/Fail Referral Criteria". American Electromedics Corporation.

Sameroff,A. "Cognitive Limitations of Parental Coping Skills" paper presented at the meeting of the Handicapped Children's Early Education Programs, Washington, D.C.,December,1982.

Sammons,W. "Premature Infants: Who's Really At-Risk". paper presented at the meeting of the Handicapped Children's Early Education Programs,Washington,D.C.,December,1982.

Sarff,L.S. "An Innovative Use of Free Field Amplification in Regular Classrooms". In Roeser & Downs (Ed.), Auditory Disorders in School Children,1981.

Sataloff,J. Hearing Loss. Philadelphia: J.B. Lippincott, 1966.

Schatzman,L. & Strauss,A.L. Field Research: Strategies for a Natural Sociology. New Jersey: Prentice-Hall,1973.

Shapiro,G.G. et.al. "Treatment of Persistent Eustachian Tube Dysfunction in Children with Aerosolized Nasal Dexamethasone Phosphate versus Placebo". Annals of Allergy, August,1982,49,81-85.

Silva,P.A. et.al. "Some Developmental and Behavioral Problems Associated with Bilateral Otitis Media with Effusion." Journal of Learning Disabilities1982,15,7, 417-421.

Sonnenschein,P. "Parents and Professionals: An Uneasy Relationship". Teaching Exceptional Children. November, 1981,62-65.

Stack,J. (Ed.) The Special Infant: An Interdisciplinary Approach to the Optimal Development of Infants. New York: Human Sciences Press,1982.

Travers,J. Educational Psychology. New York: Harper & Row, 1979.

Wabash and Ohio Valley Special Education District. "?MARRS". Norris City, Illinois, Title IVc,ESEA Project Report.

Warren,R.M. Auditory Perception: A New Systhesis. New York: Pergamon Press,1982.

Wiig,E.H., & Semel,E. Language Disabilities in Children and Adolescents. Columbus: Charles E. Merrill,1976.

Willeford,J. & Billger,J. "Auditory Perception in Children with Learning Disabilities" in Katz,J. (Ed.), Handbook of Clinical Audiology (2nd ed.) Baltimore: Williams & Wilkins, 1978.

Williams,R. & Long,J. Toward a Self-Managed Life Style. Boston: Houghton Mifflin,1979.

Zinkus,P.W. et.al. "Developmental and Psychoeducational Sequelae of Chronic Otitis Media". American Journal of Diseases of Children,1978,132,1100-1104.