REPORT OF THE
DEPARTMENT OF EDUCATION

A Study of the Feasibility of Establishing Comprehensive Hearing Screening Programs in Virginia Public Schools

TO THE GOVERNOR AND
THE GENERAL ASSEMBLY OF VIRGINIA

SENATE DOCUMENT NO. 8

COMMONWEALTH OF VIRGINIA
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COMMONWEALTH of VIRGINIA

DEPARTMENT OF EDUCATION
P.O. BOX 60
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TO: Members of the 1989 Session of the
General Assembly of Virginia

FROM: S. John Davis
Superintendent of Public Instruction

SUBJECT: Senate Joint Resolution No. 5

As requested through Senate Joint Resolution No. 5, the Department of Education hereby submits its report for your review and consideration.

SJD:nmd

Attachment

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EXECUTIVE SUMMARY

The 1988 General Assembly passed Senate Joint Resolution 5, directing the Department of Education to study the feasibility of establishing comprehensive hearing screening programs in Virginia's public schools. Such a program should be based upon the successful regional hearing screening program, Project HEAR (Hearing Education and Resources).

This study looked to a number of sources: current state guidelines and regulations, current state practices with regard to hearing screening, comprehensive hearing conservation programs which have been established both in Virginia and other states, and the literature which connects the occurrence of recurrent otitis media to language, learning and behavior difficulties in children. The following statements summarize the findings and conclusions reached by the Task Force upon which their recommendations are based.

1. The purpose of a screening program is to identify individuals who are likely to have a disorder. Puretone screening and tympanometric screening are used in a hearing screening program to identify the possible presence of different types of hearing, both of which require follow-up to assess medical status and determine if educational performance is affected.

2. The results of Project HEAR (Hearing Education and Resources) indicated that: (1) Mass hearing screenings can be conducted on children in grades K through 3 at an average cost of $1.24 per screening; (2) hearing screenings can be completed in two minutes per child; (3) results of the hearing screenings revealed that 11% of the children tested failed 2 screenings and were identified as being "at risk" for possible hearing loss; and (4) a significant number of students (5%) was found to be in need of medical attention following the physician's screening.

3. Hearing loss is known to affect language development and academic performance. The earliest possible identification and intervention is necessary to minimize the effects.

4. Recurrent otitis media has been found to negatively impact upon language development, academic achievement and behavior in a high number of children. Prevention of recurrent otitis media can play an important part in the prevention of language and academic problems in children.

5. A high percentage of students enrolled in handicapped programs for the learning disabled have a history of otitis media.

6. Current regulations for the testing of hearing in the schools of Virginia are addressed in both special education regulations and requirements for general health screenings. No single document clearly delineates all requirements with regard to hearing testing, and as a result, there is confusion regarding hearing screening requirements.

7. The vast majority of Virginia's school divisions are attempting to meet what they consider to be the minimum requirements for hearing screening.

8. Many school divisions are not complying with the requirement that the hearing of all students referred to special education be assessed.

9. The forms used to report hearing status lack the precision necessary to insure that hearing has been screened and/or remediated.

10. Initial school hearing testing is done currently by either nurses, speech-language pathologists, or combined efforts of these professionals in most school systems. Audiologists are not generally involved in mass screening of hearing.

11. Speech-language pathologists report spending anywhere from several days to an entire month completing hearing screenings. This represents time lost from providing therapeutic services. Students identified as speech-language impaired with an IEP cannot be denied services while a hearing screening program is completed.

12. A program which utilizes both puretone and tympanometric screening is needed in order to identify both children with sensorineural hearing loss and those with fluctuating conductive hearing loss accompanied by middle ear abnormalities.

13. The majority of Virginia school divisions do not currently use tympanometry as a screening procedure. Most divisions use puretone screening alone or supplement puretone screening with tympanometry when a child fails puretone screening. Used in this manner, tympanometry functions as a second level diagnostic procedure.

14. Most school divisions use 25db as the pass criteria for puretone screening. Such procedures would fail to identify approximately 50 to 70% of the children with abnormal middle ear status. Without identifying the hearing loss the children are "at risk" for experiencing language and learning deficits.

15. Impedance screening, or tympanometry, is a fast, accurate, noninvasive procedure for identifying middle ear disorders.

16. Tympanomtric screening was successfully incorporated into school screenings through Project HEAR with costs averaging $1.24 per child per screening (excluding equipment costs). The cost effectiveness of incorporation of tympanometry into existing puretone screening programs has been demonstrated in other school divisions.

17. Follow-up procedures are a vital part of any screening program and must be addressed by the designers of the program. No follow-up is mandated by the laws which require mass hearing screening in specified grade levels. The degree of follow-up currently undertaken depends solely on the commitment of the personnel at the local level.

18. Parental, community, and school personnel education are important aspects of a comprehensive hearing health care program. Without cooperation from these areas, medical follow-up and educational modifications will not occur, making a program essentially useless.

19. School screening programs should attempt to reach preschool children since (1) early identification of hearing loss is crucial; (2) prevalence of middle ear disorders is greatest among preschoolers; and (3) untreated, early onset recurrent otitis media may have more serious long-term educational implications. This can be addressed via community education as part of the Child Find program and screening of all preschool children enrolled in the local division.

The following recommendations are made:

1. A statewide comprehensive hearing conservation program should be established to provide hearing health care services to children served by the school systems of Virginia.

2. A comprehensive hearing conservation program would consist of identification, referral, in-service education for teachers, and involvement of parents and members of the local medical community.

3. It is recommended that the Supervisor of Health Services should be responsible for coordinating the program at the state level, in cooperation with the Supervisor of Speech-Language and Hearing Impaired Programs.

4. It is recommended that a person should be identified in each local educational agency who is to be responsible for coordination of a comprehensive hearing screening program at the local level. This person should be responsible for execution of the hearing screening, administration of in-service and educational programs, and implementation of referral and follow-up procedures.

5. It is recommended that audiologists, registered nurses and/or speech-language pathologists should be responsible for on site supervision and execution of puretone and tympanometric screening. These persons must have expertise in the administration and interpretation of puretone and tympanomtric screening. The use of speech-language pathologists should not cause cancellation of therapy services for any identified speech-language impaired student. Other staff may be used as needed, following proper training, and with a previously identified specialist on-site.

6. It is recommended that the state provide start-up funds to all local education agencies to initiate a comprehensive hearing screening program.

   A) This should amount to a grant of $3,000 for the purchase of 1 tympanometer for every 1000 students in grades K, 1, 2 & 3, and all preschool handicapped students. This would not supplant tympanometers the school divisions currently own. This should amount to a total equipment cost of approximately $750,000.

   B) Start-up costs should also include intensive training of school divisions in executing hearing screening programs. Initial training costs of $75,000 should be funded. This should include personnel to complete hands-on training, and development of a "trainer of trainers" manual for audiologists.

7. It is recommended that screening should be provided to students as follows:

   Puretone Screening:
   - all students in grades K, 3, 7 and 10
   - all new students
   - all students referred to the Child Study Committee and/or special education supervisor
   - pre-schoolers identified in Child Find procedures
   - any student referred by the teacher
   - any student failing tympanometry
   - all students failing in previous years

   Tympanometry:
   - all students in grades K-3
   - all students referred to the Child Study Committee and/or special education supervisor
   - all new students in grades K-3
   - any student referred by the teacher
   - preschoolers identified in Child Find procedures
   - all students receiving special education services
   - all students failing in previous years

8. All Kindergarten and new students must be screened within the first sixty days of a school year. Hearing screenings involving puretone and tympanometry should be conducted for all students being assessed to determine eligibility for special education immediately following referral to the supervisor of special education. Early screening allows sufficient opportunity within the 65 days timeline. The time line for all other screenings and referrals is to be decided by the local educational agency.

9. Certain protocols are recommended for screening procedures to insure greatest validity and reliability of screening results.

10. The types of equipment purchased for school screening purposes should meet certain criteria.

11. A two phase in-service training program should be included as part of a comprehensive hearing screening program. Such an in-service program should include (1) training screening participants and (2) informing teachers of the effects of hearing loss on language and learning and of the accommodations which can be made to accommodate the hearing loss.

12. Referral and follow-up should be monitored by the designated program coordinator.

13. Children "at risk" should <u>not</u> be placed in "open" classrooms due to the high noise levels present in these settings.

14. Form "MHC 213 B: School Entrance Physical & Immunization Certificate" should be revised to require evaluation of hearing, to ensure that hearing is normal. The form should also cue the physician to report a history of otitis media.

15. Form "LF.011: Summary of Physical Defects and Corrections" should be revised to specify the nature of the "ear deficit".

INTRODUCTION

Purpose of the Task Force

On March 11, 1988, Senate Joint Resolution No. 5 was offered requesting that the Department of Education study the feasibility of establishing comprehensive hearing screening programs in grades K-3 of Virginia's public schools. The study request followed successful administration of a three-year Department of Education grant-funded program entitled Project HEAR (Hearing Education and Resources) by the school divisions of Clarke, Frederick, Warren and Winchester. Based on the premise that children who experience repeated episodes of intermittent hearing loss may be misdiagnosed as exhibiting behavior or learning disabilities, or may remain undiagnosed until significant language and learning problems result, Project HEAR utilized tympanometry as a quick, painless, and noninvasive method for evaluating the middle ear status of school children. The tympanometric procedures were used in grades K-3 in addition to the already in-place audiometric puretone screening as required by Virginia school law 22.1-273. Accurate assessment of hearing was judged by the designers of Project HEAR to be a critical part of each child's on-going assessment during the primary grades. In addition to assessment, the program included in-service training for classroom teachers to promote a greater awareness of the educational needs of children suffering from intermittent conductive hearing loss due to disorders of the middle ear.

Senate Joint Resolution No. 5 requested that the Department of Education obtain input from Project HEAR personnel, representatives of the Virginia Academy of Otolaryngology, and from the Speech and Hearing Association of Virginia in studying the nature and feasibility of "comprehensive" hearing screening programs in grades K-3. Findings and recommendations of such a study are to be presented by the Department of Education to the 1989 session of the General Assembly. To comply with this request, a task force composed of representatives from each of the above-mentioned groups, as well as representatives from several school districts, the Virginia Department of Health, the Department of the Deaf and Hard of Hearing, and the State Special Education Advisory Committee was formed under the direction of Dr. Lissa Power Cluver, Associate Director for Special Education programs. The membership of the committee, the goals established by the participants, and an overview of the contents of the Task Force Report follow.

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GOALS OF THE TASK FORCE:

To review the components of Senate Joint Resolution 5 and determine what information is necessary to fulfill the study objectives

To review current Department of Education requirements regarding hearing screening

To review Project HEAR

To gather information on and review current practices in school systems throughout the state and program models in other states

To review and consider the impact of recurrent otitis media on language and academic development via a review of the literature.

To examine each of the above components and provide recommendations as requested by the General Assembly

CONTENT OF THE TASK FORCE REPORT

In order to fully evaluate the feasibility and advisability of establishing comprehensive hearing screening programs in grades K-3 based on the Project HEAR model, the Task Force delineated several areas which were to be included in the report. The first of these factors includes the guidelines and practices currently in effect in Virginia with regard to both mass grade level screenings and hearing assessment of students recommended for Child Study proceedings. Several sources were used to obtain information, including the Department of Education "Program Guidelines for Audiological Services in Virginia's Public Schools", Senate Document 22, 1987 and Virginia School Laws. The forms currently in use for health records were reviewed as to their treatment of hearing information. Additionally, each local education agency in the state was surveyed to gather information on hearing screening procedures used locally.

Following the section on current practices, an indepth description of Project HEAR is presented. Included are a summary of the project, statistics, costs, procedures, and evaluations of the various aspects of the program. Several other programs which studied the use of tympanometry in comprehensive hearing screening of school children are summarized including a four-year program in Harrison County, West Virginia and a model program established in the Kansas City, Missouri School District.

In considering the desirability of implementing a comprehensive hearing screening program which includes routine use of tympanomtric screening in addition to puretone audiometric screening, the report contains a summary of literature on the effects of recurrent otitis media on language development and academic achievement. Current practices in diagnosis of otitis media are also summarized. (An explanation of terms related to otitis media is found in the Glossary).

The final section of the report summarizes the findings and outlines the recommendations of the Task Force.

RATIONALE FOR HEARING SCREENING

The goal of a school hearing screening program is to identify those children who probably do have a hearing problem from those individuals who probably do not have a hearing problem. Establishing a diagnosis is not an appropriate expectation for a screening program. Once a child fails a screening, all that is known is that this child is more likely than the child who passed the screening to have a hearing problem. Students failing a screening are determined to be in need of further evaluation in a setting which allows for more careful and extensive diagnostic procedures. Obviously, the more accurate a screening program, the more efficiently those who probably do have a problem can be separated from those who probably do not. This results in fewer students who do not have a problem being sent for further unnecessary evaluation, while at the same time ensuring that most of those who do have a problem are referred for further evaluation and diagnosis.

Nearly every state has an active hearing screening program, and in more than half the states hearing screening is mandated by law. For more than 40 years hearing screening has been one of the most vigorous screening procedures in school health programs (Northern, 1980). Currently, using a puretone screening audiometer to evaluate one child at a time is the most commonly used procedure for school screening. The standard puretone screening method successfully identifies those children with sensorineural hearing loss who can be assisted with proper fitting of amplification and/or remedial education procedures. However, the prevalence of school children with sensorineural hearing is less than 10% of those children who have actual or potential aural problems. The remaining 90% have conductive hearing loss mostly due to middle ear effusion. The puretone screening method would miss approximately half of the children evidencing abnormal middle ears (McDermott, 1982).

A comprehensive hearing conservation program in the schools must provide a means for identifying all children with non-normal hearing in order to prevent educational problems resulting from the hearing impairment. The identification of children with middle ear disorders and conductive hearing losses which can be medically treated is of the utmost importance. If left untreated middle ear disease, in particular otitis media, may lead to serious medical complications such as permanent sensorineural hearing loss, ossicular fixation through adhesions, tympanometric membrane perforations, cholesteatoma, ossicular necrosis, mastoiditis, and meningitis (Northern, 1980). However, of greater impact on educational systems is the possible relationship between recurrent otitis media and language development and academic deficits. Early identification and treatment of middle ear disorders could decrease the possibility that either medical or educational consequences occur.

Acoustic impedance testing is an objective test which assesses the integrity of the middle ear system without requiring a response from the child. The use of impedance testing enables screening programs to identify children with middle ear disease with substantially more accuracy than puretone testing. The combined use of impedance and puretone testing in a school hearing conservation program increases the overall accuracy of the screening process, ensuring that children with both sensorineural hearing loss and middle ear disorders will be identified and receive either the educational or medical assistance they need (Northern, 1980).

CURRENT STATE REQUIREMENTS AND GUIDELINES

The need for providing a hearing screening program in public schools has been previously established in Virginia. Virginia School Laws have addressed procedures for hearing evaluations of both special needs students (Sec. 22.1-214, part A) and those in regular programming (Sec. 22.1-273). The recommendations included in the 1980 Guidelines for Audiological Services in Virginia's Public Schools were prefaced with the following statements:

The identification of hearing impairment is an integral part of public school health services. Because hearing impairment is not always an easily recognized problem, identification programs are of great benefit in determining those children whose educational progress is being adversely affected by a hearing impairment. The impairment may be conductive (middle ear and medically treatable) or sensorineural (inner ear and irreversible) in nature and range from no interference with educational progress to the need for self-contained class instruction with a teacher for the hearing impaired. Audiological services include hearing screening, impedance audiometry, puretone threshold testing, speech audiometry, and a variety of related services to hearing impaired children in public schools.

Because of the recognized effects of hearing impairment on educational progress and personal-social adjustment, audiological services are an essential school health service. This is particularly true for kindergarten and the primary grades where an unidentified hearing problem can affect the development of essential language skills which are necessary for future academic growth.

Recognition of the importance of hearing health care in the schools has led to the adoption of directives, recommendations for implementation of the directives, as well as development of extensive guidelines for programs seeking to provide more comprehensive audiological services than those required by law. Senate Document 22 (1987), a task force report on the health status of Virginia's school children, includes reference to hearing health. On page 11 of that document, it is stated that "visual screenings and hearing assessments are required by State law to be performed on all children". The report goes on to say that all school divisions reported conducting such screenings at the elementary level, but at the secondary level compliance falls off significantly. Recommendation #20 of the Task Force states:

The State Department of Education should continue to monitor and insist that all schools comply with state laws pertaining to vision and hearing assessments.

STATE REQUIREMENTS IN STATE CODE AND REGULATIONS

Article 2, Chapter 7, Virginia School Law is concerned with provisions for special education. Section 22.1-214 specifies requirements for the testing of hearing, specifically:

(i) that the hearing of each handicapped child be tested prior to placement in a special education program and;

(ii) that a complete audiological assessment, including tests which will assess inner and middle ear functioning be performed on each child who is hearing impaired or who fails the test required in (i) hereof.

Also found within the Regulations Governing Special Education Programs for Handicapped Children and Youth in Virginia (September, 1984) is the requirement that:

> all children, within 60 administrative working days of initial enrollment in a public school shall be screened in the following areas to determine if formal assessment is indicated: (a) speech, voice and language; (b) fine and gross motor functions; (c) vision and hearing.

Under special education provisions as stated, hearing screening would be necessary for all children new to a system which would include both kindergarten enrollees and transfer students. In addition, any child recommended for special education placement is required to have his hearing tested "prior to placement in a special education program". Full audiological evaluation is required for students being considered for special education placement who fail an initial hearing test.

School Law Section 22.1-273 also addresses hearing health care for students. Under this provision:

> ...Within a period of time to be established by the Board of Education, the principal of each school shall test the sight and hearing of all the pupils in the school and keep a record of such examinations....

The regulations governing special education programs address assessment procedures to be used with children being considered for special placement. The regulations state that the child must be assessed in all areas related to the disability including health and vision, social and emotional status, general intelligence, academic performance, communicative status and motor abilities. Testing of hearing is specifically required for every child prior to placement in a special education program. This may be a hearing screening, except for hearing impaired and deaf-blind students.

The time frame for provision of hearing testing and audiological evaluation of students undergoing special education eligibility proceedings is not clearly specified. Conceivably, the testing of hearing and vision might not be accomplished before educational and psychological assessment are initiated, even though results of these evaluations may suggest a need for modification of normal testing procedures.

This variety of mandates regarding hearing screening requirements has left confusion in a number of school divisions. A review of the Administrative Reviews completed by the Virginia Department of Education from 1985-86 through 1987-88 revealed that local school divisions have difficulty complying with these mandates. Twenty-three (23) of eighty-one (81) divisions (28%) were found not to be in compliance with this requirement.

In order to alleviate the confusion on the part of some school divisions, the clarification of the wording in the Regulations is being proposed to require an audiological evaluation following the failure of two hearing screenings. In addition, the Department of Education has issued a clarification, by way of Superintendent's Regulatory Memorandum, of the hearing screening process. It specifically recommends that hearing be screened early in the assessment components for eligibility for special education, in order to make appropriate accommodations to other assessment components of the child who is hearing impaired. Follow-up procedures, and the requirement that school divisions are responsible for audiologicals if the child fails the hearing screening and is referred for special education,

are also included. Hearing evaluation is included as a component only in the cases of hearing impaired and deaf-blind children.

The regulations also state that minimum assessment requirements shall be completed by qualified professionals. In the case of audiological assessment, the qualified professional is an audiologist, a professional who holds a current Virginia license issued by the Virginia Board of Examiners for Audiology and Speech Pathology.

Summary

Virginia school requirements address hearing testing both in Special Education regulations and in requirements for health care of all public school students. Testing of hearing is specifically required (by a combination of these requirements) for the following students:

- -all students being considered for special education placement (during the assessment period), followed by a complete audiological evaluation for students failing hearing screening;
- -all students new to a system (within 60 days of enrollment);
- -all students in grades K, 3, 7, and 10 (within 60 days of the beginning of school).

Several issues were identified by the Task Force as concerns regarding the current requirements for hearing testing in Virginia. The regulations under special education use both the terms "hearing testing" and "audiological evaluation". "Audiological evaluation" is defined only as including tests which assess middle and inner ear functioning while "hearing testing" is not specified further. The wording of School Law 22.1-237 states only "...test the sight and hearing...", while the recommendations for implementing this regulation state that "...sight and hearing...be screened....". The distinction between hearing testing, hearing screening, and audiological evaluation may require clarification. Another possible point for clarification involves the testing of kindergartners who appear to be covered by the new enrollee section of the Regulations Governing Special Education Programs for Handicapped Children and Youth in Virginia, and under the recommendations for implementation of School Law Section 22.1-273. There is a lack of clarity as to whether the screening of kindergartners' hearing and vision has been evaluated in the required pre-entrance physical examination by a physician, thus the question arises as to whether school screenings are necessary.

Program Guidelines for Audiological Services in Public Schools

The Division of Special Education Support Services of the Department of Education in cooperation with providers of audiological services from various settings across the state developed a document (1980) designed to be used by school systems as a foundation for implementation or expansion of audiological services. The document begins by distinguishing between "identification audiometry" and the "hearing conservation" program. Identification audiometry is defined as "the original discovery of a hearing impairment which results in the isolation of an individual as one to be

watched or examined further". The hearing conservation program is described as "a cooperative program of school and community health officials for providing medical, surgical, audiological, educational and related services required to prevent and overcome hearing impairment." A conservation program would include not only identification audiometry, but also medical referral and treatment when necessary, as well as providing for the earliest possible remedial or educational intervention. Also stressed is the importance of educating the classroom teacher about the nature of auditory problems, the need to be alert to possible hearing disorders, and how to assist children with impaired hearing ability in the classroom. The guidelines stress that the concerted efforts of all persons associated with educational and medical services for children is required for the realization of an effective statewide hearing conservation program.

Practical guidelines were provided for three levels of audiological services within school systems:

Stage I: Puretone air conduction testing only
Stage II: Puretone air conduction and tympanomtric screening
Stage III: Puretone air and bone conduction and tympanomtric screening

The use of Stage I was considered a minimal service which should be replaced with Stage II when possible. The Guidelines make recommendations about which students should be included for puretone and tympanometry testing, the personnel who should conduct the testing, the types of equipment needed and the facilities which are necessary for the testing to be accurately accomplished. Screening protocols and pass-fail criterion suggested by the Guidelines are summarized below:

1. Recommended grades to be screened:

   a. Puretone screening
      - grades K, 1, 2, 3, 6, and 9
      - all newly enrolled students
      - teacher referrals
      - children with confirmed hearing impairment receiving services are excluded from screening

   b. Tympanometry
      - grades K, 1, and 3

2. Suggested Personnel

   a. Puretone screening
      - public health or school nurses
      - speech-language pathologists
      - resource teachers of the hearing impaired
      - trained volunteers

   b. Tympanomtric screening
      - trained personnel under experienced supervision

3. Pass-Fail Criterion

   a. Puretone Screening
      - test frequencies: 500, 1000, 2000 and 4000 Hz
      - test level: 25 db
      - failure criterion: no response at two adjacent frequencies

   b. Tympanomtric screening
      - no pass-fail guidelines provided

4. Follow-up Procedures

   a. Puretone Screening
      - rescreen in two weeks
      - refer for complete audiological including air, bone and impedance
      - refer for medical treatment if indicated by complete audiological including tympanometry
      - refer for child study if no medical indications

   b. Tympanomtric screening
      - no follow-up procedures specified

As part of the total hearing conservation program recommended by the Guidelines, a program of in-service training for personnel doing the testing and for classroom teachers is suggested. An extensive outline for in-servicing personnel was developed and included in the Guidelines.

The Guidelines also suggested that school divisions assess their community resources including the possibility of pooling resources among divisions to provide an audiologist for supervision of services and in-servicing. Such a cooperative program has been established by several southwest Virginia school divisions as well as those participating in Project HEAR.

FORMS RELATING TO PHYSICAL EXAMINATION:

Form MHC 213 B: School Entrance Physical Examination and Immunization Certification

This form must be completed on each child entering a school system in the Commonwealth of Virginia. In addition, this is frequently used to report the results of the medical evaluation required for all students referred for special education. Since this form was originally designed to meet school entrance physical examination and immunization requirements, information relevant to special education assessment is either abbreviated or summarized. As a result, members of the Task Force found this form to be incomplete in the hearing section. Currently the form includes:

"Hearing: R_____ L_____"

No guidelines are given for the type of information requested. It has been suggested that physicians use differing criteria in providing information on "hearing". In addition, many forms are not thoroughly completed and information regarding hearing may be absent or forms may reflect an examination which was before the initial enrollment and, therefore, does not reflect current health status. All Task Force members felt that specific test data should be requested, to insure that a hearing screening/assessment be completed, as opposed to only a visual inspection of the ear.

The health history section requests information on "serious illnesses, accidents, operations, nutritional, dental, mental or emotional problems or handicapping conditions". Recurrent otitis media would not appear to fit appropriately into any of these categories, even though it might be to the child's benefit for school officials to be aware if such a history exists.

Form LF.011: Summary of Physical Defects & Corrections

An additional form, LF.011: Summary of Physical Defects and Corrections, must be completed by each local educational agency in April or May of the school year. The form requests information on identified defects of the eyes and ears, categorized by sex. The form also asks for a count of corrections of the defects. The form does not request specification of defect, thus sensorineural losses would not be viewed separately from conductive losses associated with otitis media. Similarly, no explanation of corrections is provided. Thus, "corrected" may be viewed to mean that the child obtained a hearing aid, or that medical resolution was obtained.

Other Physical Examination Forms

A medical examination must be completed before students can determine eligibility for special education. Frequently this is accomplished with Form MHC 213 HB. However, the physical examination request for students involved in high school athletics has been used to meet this requirement. Such physical examinations frequently do not include data regarding hearing status.

STATEWIDE SURVEY RESULTS

An important source of information considered by the Task Force was a survey conducted throughout the state requesting information on current hearing screening practices in each local division. Members of the Task Force were interested in the types of health personnel being utilized by the school divisions, including clinical nursing, medical and audiological personnel. In addition, inquiry was made as to hearing screening practices such as program coordinators, testing personnel and protocols, and follow-up procedures currently in use. By way of Superintendent's Memorandum, all school divisions (137) were requested to identify personnel who could respond to an in-depth survey of hearing screening practices. One hundred and nine divisions responded with a designated contact person. One hundred and one divisions provided results which could be included in the survey. This comprises 74% of all school divisions in Virginia.

1. Who staffs school health clinics?

Personnel	Total School Divisions
RNs	55
LPNs	10
Parent Volunteers	4
Public Health Nurses	25
Other	10 (school personnel)
No Health Services	
(N >100 due to duplicate responses)	

2. How many of each type of staff are used to provide clinical health services?

Personnel	Numbers of Personnel Used			
	1-3	4-6	7-10	>10
	(Number of Divisions)			
RNs	41	5	2	7
LPNs	8	1	1	
Volunteers	4			
Public Health Nurses	22	1		2
No Health Services (7)				N = 101

3. How are clinical health services provided at different school levels?

Level	Manner of Service Delivery/ Number of Divisions		
	Regular Visits	On Call	No Direct Service
Primary	52	28	21
Middle	46	24	31
High	48	27	26

4. Does your system contract with outside medical consultants?

Seventy-two school divisions responded that they do contract with outside medical consultants. The most common reasons for outside consultations were for special education evaluation physicals. The Public Health Department was a frequently named consulting source, along with local private physicians. Neurology, psychiatry, occupational therapy and physical therapy were also mentioned. Many systems reported having a specified source to which a child would be taken, even though no formal agreement existed. Two divisions reported having physicians on staff.

Fees ranged from $15 to $45 for a physical examination, with $25 being the most commonly cited figure. Other specialists were paid typical fees for their services. Payment was typically on a per-child basis, with only one division reporting payment of a flat fee to a physician for regular visits to the division.

5. Does your system employ an audiologist?

Ten systems reported having an audiologist on staff. Several divisions share the services of an audiologist in the southwest Virginia region.

6. Does your system contract with an audiologist?

Most systems reported that they had a specific source for audiological services to which they referred when such services are needed. However, with the exception of the systems involved in Project HEAR, no division consulted with an audiologist to work with hearing screening programs.

7. Who coordinates the hearing screening program?

Personnel	Number of Divisions
Nurses	41
Speech-Language Pathologists	37
Audiologists	3
Parent Volunteers	—
Other	20
	N = 101

The "Other" category contained such personnel as Pupil Personnel Director, Director of Special Education, and Teacher of the Hearing Impaired.

8. Who executes the screenings?

Personnel	Number of Divisions
Nurses	69
Speech-Language Pathologists	70
Audiologists	7
Parent Volunteers/Other	13

These numbers reflect the fact that many systems are using more than one type of personnel to meet the screening requirements.

9. How many personnel are involved in the screening process?

Responses varied widely and ranged from one to more than 50, based on the size and resources of the school district. In most cases, all nurses and/or speech-language pathologists in a division were involved in the initial screenings. Audiologists were more frequently involved in rescreenings.

10. Are in-services provided for persons involved in the screenings?

Forty-six systems indicated that some type of in-service is provided. Most typically, in-service is provided on test procedures and use of equipment for new personnel or when new equipment was purchased. Training was generally provided by the Program Coordinator, a nurse or speech-language pathologist, or a company representative.

11. What screening procedures are used?

Procedure	Number of Divisions
Puretone screening only	57
Tympanometry only	--
Both routinely	11
Puretones only if tympanometry abnormal	--
Tympanometry only if puretones abnormal	26
Acoustic reflexes	2
Both on certain populations (K; Sp.Ed.)	5
	N = 101

12. What type of equipment is currently being used?

The most frequently used audiometers included those made by Beltone and Maico. Tympanometric equipment varied to a larger degree, with Madsen, Grayson Stadler, Welch Allyn, Teledyne, Maico and Macromatic all being mentioned.

13. When are hearing screenings conducted?

All 101 respondents reported compliance with the regulation to screen new students within the first 60 days of school. Other grade levels were screened at times varying from "September-October" to "whenever possible."

14. Please estimate the amount of time required to complete your initial hearing screening program.

Time Required (in weeks)	Number of Divisions
1 or <1	17
2	15
3	19
4	26
>5	24
	N = 101

15. Which students receive hearing screening services?

All kindergarten and other new children were screened by all 101 of the responding divisions. Four of the divisions screened every grade and an additional four screened all grades except grades 11 and 12. Grades 3, 7, and 10 were the most frequently screened groups, with 60 divisions screening both third and seventh grades and 50 divisions screening tenth graders.

16. What pass-fail criteria do you use?

Screening Level in dB HL	Number of Systems
15	2
20	19
25	60
30	7
35	1
Respondent did not know	12
	N = 101

17. What follow-up procedures do you use?

Eighty-three systems rescreen, then notify the parent that the child needs further evaluation. Seventeen systems do not rescreen prior to notification of parent and/or referral.

18. When is rescreening completed?

Time Between Screenings (in weeks)	Number of Systems
1	23
2	45
3	3
4	8
>5	4
Varies	16
ASAP	2
	N = 101

19. How do you notify parents?

Method of Notification	Number of Divisions
Letter	62
Phone call	13
Both	26
	N = 101

20. Do you refer for further evaluation?

All 101 respondents indicated that they do refer for further evaluation if the child fails the screening criteria. Several referral sources were given.

Referred To	Number of Divisions
Family Physician	51
Ear, Nose and Throat Physician	1
Audiologist	18
Speech and Hearing Center	1
Parent	6
Public Health Service	13
More than one source	11
	N = 101

Eighty-nine systems report that they follow-up on referrals. This is most often done by requesting notification from a physician regarding the results of the visit. Follow-up may be done by nurses, speech-language pathologists, audiologists, or principals. Eleven systems reported that they either do not follow up referrals or that they try, if possible, to follow up.

21. Is there any other information about your hearing screening program you would like to share with us?

Two common concerns were most frequently voiced. The first dealt with the lack of time and personnel to effectively conduct follow-up. The second area concerned the amount of time taken away from other responsibilities, in particular, the provision of therapy services by speech-language pathologists while completing hearing screenings.

PROJECT HEAR (HEARING EDUCATION AND RESOURCES)

Project HEAR (Hearing Education and Resources) is a three year grant program submitted by the school divisions of Frederick, Clarke, Winchester and Warren under grant title "Regional Programs for Students with Low Incidence Handicapping Conditions".

The program had two major purposes:

- to identify students with and/or "at risk" for intermittent conductive hearing loss

- to educate classroom teachers regarding effective referral of and intervention strategies for assisting students with intermittent conductive hearing loss in their classrooms

Project HEAR was not intended to replace the current hearing screening programs in place in the participating school systems, but instead, to target a somewhat different population. Rather than simply screening for significant hearing loss, Project HEAR procedures were aimed at those children who may evidence normal hearing at times, but who are subject to bouts of intermittent hearing loss due to recurrent otitis media. These children are not necessarily identified by hearing screening programs used in schools. Many of these children can pass puretone screening at a 25 decibel presentation level, yet are coping with hearing which may change periodically. McDermott (1982) states that the puretone screening method misses nearly one-half of the children with abnormal middle ears. The literature which examines the effects of this inconsistent auditory input on language and academic development is reviewed in this document. Rather than relying on standard puretone hearing screening procedures to identify hearing loss, Project HEAR utilized tympanometry, a method of assessing the status of the middle ear which is quick, painless, and requires no response from the child.

Pass-Fail Criteria

Tympanometric testing is an indirect measure of the mobility of the ear drum. The test can show how much the ear drum moves, at what point relative to normal air pressure it moves most effectively, and measures the size of the ear canal. The degree of movement may fall within a range considered to be normal, or may be less mobile (stiff) or more mobile (flaccid). Both of these conditions may affect hearing. This test is measured in millimeters of water pressure and termed "compliance". The point at which the ear drum moves most efficiently is called the middle ear pressure. The eardrum may move most effectively at ambient air pressure, the normal condition. Or the eardrum may display negative pressure readings, indicating a retracted eardrum which does not move efficiently under normal conditions. Positive pressure conditions may occur as well. Extremes of either of these conditions will often affect auditory acuity, or may lead to additional complications. The size of the canal falls within normal range for children and adults. Readings which show very large sizes relative to the norms may indicate that the eardrum is not intact, and the entire middle ear space is being measured. This can occur when a child has tubes, or if the eardrum has ruptured.

A child was recommended for rescreening when exhibiting limited mobility of the eardrum, as demonstrated by these measurements:

Compliance	less than .3 mmH20
Pressure	-200 daPa or less +80 daPa or greater
Volume	excessive volume

Children at the primary levels of grades K-3 participated in the program. Preschool and children receiving special education services were added to the program based on the higher risk of these populations for middle ear disorders. Test results were used to identify an "at risk" population of students (defined by the Project as those who failed two screenings). The health records of these students were flagged to alert those involved with the child of the possibility of fluctuating hearing and the possible need for implementation of compensatory strategies.

In addition to the identification portion of the program, Project HEAR provided a series of in-services for classroom teachers to help them understand the relationship of hearing loss to language/learning problems. Teachers and support personnel for each "at risk" student were invited to an in-service to discuss specific strategies and techniques to ensure the student's maximum participation in the regular classroom.

Implementation of Project HEAR including tympanomtric screening, development of the "at risk" directory, and teacher in-service, together with the puretone hearing screening already in place, comprised a Comprehensive Conservation Program, similar to that described in the Guidelines for Audiological Services in the Public Schools. A description of the personnel, procedures, time and costs used to accomplish each aspect of the program follows.

Personnel

An interdisciplinary team was used to carry out various aspects of the identification program. The team consisted of:

1. Core Audiology Team--licensed audiologists from the University of Virginia Medical Center. Audiologists completed the tympanometry screening on each child. Team size depended on school size.

2. Support Team--registered nurses, speech-language pathologists, and/or parent volunteers, depending on each individual school division. These persons performed several functions including recording of results, coordinating movement of students, noting absentees and in some cases arranging test locations and schedules.

3. Otolaryngology Consultant--a local physician contracted by Project HEAR to participate in the final screening process. Children failing the first two screenings were evaluated by the ENT consultant at the third screening contingent with parent permission.

4. Administrative Personnel--project director and clerical staff. These personnel contacted local divisions, arranged schedules at each school, arranged for parent volunteers where used, provided lists of students names to the testing team, notified schools and parents of test results, and compiled the "at risk" lists.

Procedures

Population

1. All children in grades K-3.

2. Preschoolers and special education students were included in years 2 and 3, due to the high prevalence of middle ear disorders in these populations.

Equipment

Tympanometers used by the audiology team were equipped with recording mechanisms which permit the tester to determine whether a test should be printed, thus allowing only failures or questionable responses to be printed. The printing procedure required approximately 30 seconds to complete. Once a seal was obtained, approximately 1.5 seconds were required for the tympanometric procedure to be completed. The tympanometers provided a guide showing predetermined pass-fail criteria, and printouts provide a grid within which pass responses must occur. All units were capable of completing acoustic reflex screening. Two units would also complete puretone screening.

While the equipment was found to be satisfactory both in terms of time required for testing and portability, it was noted that back-up units were necessary due to equipment down-time during periods of heavy use.

Description of Screening Program

1. Prior to Initial Screening

   - Contacts and arrangements made with consulting Audiology team
   - Lists of students by classroom generated for each school
   - Letters sent to principals specifying schedule for screening team visit
   - Schedules for each building developed by principals
   - Arrangements made for support team personnel
   - Letters sent home informing parents of upcoming screening

2. First Screening:

   - All students in specified grades screened
   - Failures and absentees reported to principals for inclusion in second screening
   - Parents notified by form letter of either pass or fail

3. Second Screening:

   - Lists of all children failing or absent from first screening generated by class for each school

   - All students failing the first screening retested

   - All students absent from first screening tested

   - Failures and absentees of second screening reported to principals and teachers

   - Letters sent home informing parents of a pass on second screening

   - Letters sent home informing parents of a fail on second screening and requesting permission for child to be seen by consulting otolaryngologist during third screening

   - "At risk" lists, composed of children failing two screenings, developed and sent to schools, along with suggested intervention strategies

4. Third Screening

   - Lists of children failing or absent from second screening generated

   - Students with permission given by parent participate in third screening which includes tympanometry and evaluation by an ENT physician

   - Based on physician recommendation students failing the third screening are referred for additional medical evaluation

   - Letters sent informing parent of failure, need for further evaluation and requesting notification of action by physician

   - Follow-up letters sent to parents not responding to initial request, again requesting information on follow-up

Time Requirements

Testing was accomplished at an average of two minutes per child. Time requirements on a per child basis were consistent across all three screenings and in all four participating divisions. Included was the time lost during movement of students. An efficient means of getting the children to the test station was found to be vital to keeping time requirements down. Initial screenings required a slightly longer average time, suggesting that transporting greater numbers of children does cut down on efficiency. The time required to complete a given division was based on

the number of children in that division. For example, Frederick, the largest participating division required approximately 40 hours of professional time to test slightly over 2900 students for all three screenings. The smallest division, Clarke County, required about 6.6 professional hours to test 651 children during the three sessions.

The number of days required to complete testing in a given system depended on the number of testing stations available. In larger schools, three stations were used. As many as six audiologists participated in the larger division's screenings, with testing being conducted at two or three schools simultaneously. This allowed larger school divisions to be screened in three days or less.

Improved efficiency toward the end of the project resulted in lower average testing times, demonstrating that a tympanometry screening could be conducted at a rate of approximately one child per minute per tester. However, factors other than testing time probably make one minute per child somewhat unrealistic.

Testing stations were set up by 8:30 a.m. so that testing could begin as early as children were available. Testing continued until all children had been tested or until the end of the school day. Consultants then met at a central location and compiled pass-fail data for the day. At the end of a division screen, data were compiled by class, school, and division screening and provided to the project director. Data compilation required approximately two hours per day, resulting in an eight hour professional day. The support team was not involved in the data analysis.

Costs

Figured into the costs of the program were:

Consultants: Audiologists
consulting fees
travel, lodging, food

Consultant: Physician
consulting fees

Support Team
parent volunteer wages (where applicable)

Administrative and clerical time could not be computed as these were part of the school division personnel's duties.

Consulting fees for personnel are shown below:

Audiologists: $125.00/day
Physician: $2000.00 honorarium/year
Clinic Assistants: $5.00/hour

The cost per child was calculated to be $1.24 per screening. The cost ranged from $.58 to $1.62 per screening for the first screening, $.83 to $3.06 per screening for the second screening, and $3.35 to $6.29 per screening for the third screening (including physician screening). Costs to larger systems were slightly less per child, largely due to the physician's fee which remained the same regardless of the number of children seen. A cost breakdown is found in Appendix B. These figures do not include the cost of equipment purchase or maintenance. If tympanometers are purchased on the basis of one tympanometer per 1000 children to be tested, the cost would be an additional $2.50 to $3.50 per child for the first year of operation.

Results

During the three year course of Project HEAR, three screenings were conducted in each division each year. In the initial screening, all students in the targeted population present on the day of the screening were tested. Children who did not meet the criteria for achieving a "pass" and students who were absent from the first session were screened approximately three weeks later. Those students who again failed to meet the pass criteria were considered to be "at risk".

A composite of the total numbers tested over the three years and the number of students identified as "at risk" is shown below.

Year	Total Screened	"at risk"
1986	4,845	505 (11%)
1987	4,926	680 (14%)
1988	5,192	488 (10%)

Students falling into the "at risk" group were seen again and received a tympanometric examination and an otoscopic examination completed by an Ear, Nose and Throat (ENT) physician. At that time it was determined that further medical intervention was needed. Composite results for the "at risk" population are shown below.

Year	Total "at risk"	Passed	Failed (required medical intervention)
1986	505	282 (56%)	223 (44%)
1987	680	385 (57%)	295 (43%)
1988	488	195 (39%)	293 (61%)

These figures indicate that approximately 11% of the total number of children tested failed two screenings and were identified as being "at risk" for possible fluctuating hearing loss or changing middle ear status. It was toward these students that the in-services for teachers were directed.

Since they may or may not at a given time manifest certain characteristics of middle ear disorders, teachers and other school personnel should be cautious and on guard for the need to implement compensatory educational planning for these children.

Approximately 50% of that group, or 5% of the total number of children tested, were found to be in need of further medical attention. It is also notable that 17% of the "at risk" group was not seen during the ENT screening due to lack of parental permission or absence. No attempt was made to follow up on these children. Speculation could suggest that middle ear problems might have kept some of these children at home on the screening day, or that those for whom no parental permission was received might fall into a group which is less likely to receive needed medical attention. A breakdown of the numbers tested and pass-fail rates for each school division is shown in Appendix C.

Evaluation of the technical aspects of the program by school personnel was overwhelmingly positive. Ratings were consistently excellent or good on such areas as scheduling, notification of prescreening information and post-screening results. The program was seen as being conducted in a professional and timely manner and was seen as a benefit by the respondents. Follow-up was recorded as the weakest part of the program with respondents expressing frustration about having a child identified but parents failing to follow through.

Anecdotal information indicated that the combination of medical follow-up for screening failures, plus teacher modifications in the classroom increased students' success in the classroom and decreased special education referrals. The absence of a control sample limits the ability to accurately predict a change in special education referral.

In-service Program

In-services were conducted by one member of the audiology consulting team. Coordination, publicity, and evaluations of the in-services were done by the Project Director. The in-service program included both training for individuals involved in testing and educational in-service for teachers.

The in-service for training of testers consisted of both a lecture/demonstration phase and a hands-on supervised practice session with the equipment to be used in screening. These training sessions required approximately four hours total for both phases.

The in-service for teachers of children involved in the screening program also consisted of two parts. The first was an introduction to the program, explaining its goals and purposes. The second session focused on teaching strategies and techniques to optimize the learning environments of children who are identified during the screening. Each workshop was approximately one hour in length. An outline of topics for each in-service is found in Appendix A.

The cost of the in-service program was dependent upon the number of participants. Costs included consultation fees, and travel expenses, refreshments and publicity fliers. In addition, a stipend was given to each attendee in the initial year of the project to encourage participation.

The in-services were judged successful by the evaluations completed by the participants. Workshop attendees generally indicated that the content of the course was useful and meaningful to them personally. Other comments were that the workshops helped teachers to understand the problems experienced by children with fluctuating hearing loss in their classrooms, and alerted them to the possibility that a child was suffering from decreased hearing rather than a behavior or learning problem.

MODEL PROGRAMS IN OTHER STATES

There are reports in the literature of school systems in various parts of the country which have successfully implemented comprehensive hearing screening programs consisting of both puretone and immittance screening. Descriptions of two of these programs, Harrison County, West Virginia and Kansas City, Missouri follow. A summary is provided in Table 1.

Harrison County, West Virginia

This statement, found at the beginning of a report on the Harrison County Program, summarizes the value of their program:

"In 1975 the first hearing screening program in West Virginia using both impedance and puretone testing was implemented in Harrison County. The success of this program was primarily responsible for providing the encouragement to other school systems throughout the state to include impedance in their screenings."

In 1977, only a few counties were using impedance testing. At that time, the State Department of Education provided funding for a full-time audiologist in each of the eight Regional Educational Service Agencies.

With these professionals working closely with each county in their region, impedance screening has been put into place in 53 of West Virginia's 55 counties. West Virginia is probably the first state to realize the use of impedance testing in virtually all of its schools.

Impedance screening was added to the hearing screening program previously consisting of puretones only in Harrison County, West Virginia. A pilot program was conducted over a four year period from 1975-1979. The screening was conducted by nurses who had been trained by audiologists. Children were referred after the first screening if a flat tympanogram was obtained. Students evidencing excessive negative pressure were rescreened, and referred or passed on the information obtained during the second screening. A total failure rate of 16.9% was obtained over the four year project. Of these failures, 16.2% would have been identified by impedance testing alone. Puretone testing alone would have identified 4.4% of these students. A total of 382 children with confirmed problems would not have been diagnosed without the use of tympanometry. This more than doubles the number of children who would have been identified using puretone screenings only.

Notably, the smallest percentage of failures for tympanometry occurred in October when most school screenings are done. The greatest percentages of failures occurred in two peaks seen in December and April. Puretone failures maintained a fairly constant rate throughout the school year, with only a slight increase in the spring months.

As a result of the perceived success of this program, audiologists were hired for each of the eight Regional Educational Service Agencies in West Virginia. Cooperation between the audiologists and the school divisions in each region, enabled the state to implement impedance screening in 53 of West Virginia's 55 counties by 1980. A combined approach using both puretone and impedance screening was advocated.

Kansas City, Missouri

A second report on the successful implementation of a combined puretone/impedance school hearing screening program came out of the Kansas City, Missouri school district.

Of the 17,871 students tested, the initial fail rate was 17%. Following rescreening, approximately 6.2% of the total school population was found to have results requiring further medical evaluation. No attempt was made to compare screening failures with medical findings. Follow-up was seen as a weakness of the program with lack of resources given as the reason that accuracy and overreferral rates were not determined. Lack of cooperation with and education of community health personnel regarding the screenings was also mentioned as a problem.

In assessing whether testing all students in grades K-6 was desirable, it was noted that the biggest drop in referral rate occurred between kindergarten and first grade, with first, second and third graders showing no significant differences in failure rates. Program personnel concluded that an optimal impedance screening program would include grades K-3.

Testing occurred throughout the winter and early spring months, with each tester screening approximately 30 children per hour. Results indicated that grades K-3 were optimal for screening. The major problem was felt to be the lack of resources for adequate follow-up.

	Project HEAR	Harrison County W. Va.	Kansas City Mo.
Personnel	Audiologist Consultants	Audiologists Nurses Sp/Lang Path.	Audiologists Nurses Sp/Lang Path.
Population	K-3 Special Ed.	K-3 Special Ed. Referrals	K-6
Procedures	Puretone Impedance	Puretone Impedance	Puretone Impedance
Pass/Fail Criteria Puretone	Dependent on Division	20dB 1,2,4kHz	20db 1,2kHz 25dB 4KHz
Pass/Fail Criteria Impedance	Absence of pressure peak above -200mmH20 Abnormal volume	Absence of pressure peak above -200mmH20	Absence of pressure peak above-200mmH20 Abnormal volume

Table 1: A comparison of three comprehensive hearing screening programs.

OTITIS MEDIA

The literature on otitis media contains many studies which have examined the relationship between the disease process and educational and/or language deficits in children. The disease process itself is complex and cannot be described by a single characterization. Diagnosis and treatment depends on the current variation or stage of the otitis, as perhaps does the impact of the disease on the affected child. The section which follows contains: 1) a discussion of otitis media prevalence information; 2) a discussion of current techniques for identifying the disease and; 3) a review of the literature examining the effects of recurrent otitis media on children, including cognitive and social development and educational achievement.

As can be seen from the list of definitions found in the glossary, otitis media exhibits a variety of forms. The effects of one form, such as in acute otitis which quickly and spontaneously resolves, will undoubtedly differ from those of a recurrent otitis media where the child experiences repeated bouts of fluctuating hearing loss during important learning periods. Medical implications of the conditions differ as well. Active infections may be treated with antibiotics. The long term presence of serous otitis media may or may not be aggressively treated through the placement of pressure equalization tubes, depending on the viewpoint of the physician. Both situations result in conditions which must be educationally managed if the child is to experience the minimum effects of an accompanying decrease in hearing. Identification and appropriate management are important in every case to prevent potential medical and/or educational consequences.

Prevalence

The prevalence of otitis media varies across a number of factors. It is, however, recognized as the most common cause of hearing loss in the school age population. Age, socioeconomic status, sex, and the presence of certain risk factors have a bearing on prevalence of the disease. Children under the age of four have been suggested to have an average prevalence ranging from 8 to 20%, while the figure for children up to twelve is 5 to 22% (Bergstrom, 1988). Other estimates have gone as high as 30% in the school age population (Jerger, 1980). Compared with the commonly accepted figure of 1 in 1000 cases of congenital sensorineural deafness and an estimate of some degree of sensorineural hearing loss in 5% of the school population, the magnitude of middle ear disorders becomes evident. These figures suggest that there are approximately 992,000 mildly to profoundly hearing impaired students in the schools, while an estimated 2,500,000 children are affected by middle ear disease (Roeser and Northern, 1988).

Other figures suggest that males are more often affected than females and that a higher than average incidence occurs among children from lower socioeconomic situations. Prematurity, cleft palate, and Down Syndrome are also factors related to higher incidences of middle ear disorders (Todd, 1986). The time of year also appears to have bearing on the prevalence of cases of otitis media, with winter and early spring exhibiting peak incidence and summer the least (Klein, 1986).

Current Methods for Diagnosing Otitis Media

Possible methods of diagnosing otitis media include otoscopy, tympanometry and puretone hearing testing. Symptoms which suggest otitis media, such as fever and congestion, are seen with other types of illness and as such are not definitive. Each of these three procedures provides information specific to the status of the ear and plays an important role in identifying a middle ear disorder as well as providing data on the severity and potential educational impact of the disease.

Otoscopy

The examiner directly views the tympanic membrane through the use of an otoscope. An experienced observer may recognize retraction of the membrane, or the presence of fluid behind it. In addition, the presence of a perforation may be detected. Pneumatic otoscopy, through introduction of slight amounts of pressure, allows the examiner to determine whether or not the tympanic membrane is normally mobile or immobile as would be consistent with fluid in the middle ear.

Tympanometry

This procedure assesses the mobility of the tympanic membrane. The slight amount of pressure is applied to the eardrum and the ability of the ear to transmit sound through the middle ear system is measured. The procedure is automated and measures both the ability of the eardrum to move and its point of peak efficiency. These measurements have patterns

which suggest the presence of fluid or retraction of the ear drum. The presence of perforations may be suggested by tympanometric results as well. The impedance audiometer with which a tympanometric evaluation is done generally provides a graph consistent with a given middle ear status. No cooperation from the child, aside from sitting quietly, is necessary.

Puretone Audiometry

During this procedure the person being tested listens for a series of very soft sounds and indicates to the tester when a sound is heard. The testee must be cooperative and understand the task. Responses may be based on the testee's frame of reference or desire to cooperate. This test indicates hearing sensitivity but does not differentiate between sensorineural and conductive hearing impairment without the use of additional procedures which are time consuming and impractical for screening programs.

Otoscopy, puretone audiometry and tympanometry may all be used in identification of otitis media. Studies comparing the three methods have shown that otoscopy and tympanometry are similarly successful in identifying otitis media (Axelson and Lewis, 1976; Groothius et. al., 1979). However, the degree of training required for accurate identification by otoscopy makes this procedure prohibitive for use in public school hearing conservation programs. Tympanometry appears to be somewhat more sensitive to middle ear disorders which may not have reached a stage visible through otoscopy. Puretone audiometry may show the presence of the mild hearing loss which frequently accompanies otitis media. However, the use of screening procedures at 20-25 dB can easily miss that loss. Additionally, hearing loss may or may not be present at certain stages of the disease. Puretone testing as done in the screening procedure does not differentiate between sensorineural loss and middle ear conductive hearing loss.

According to the West Virginia program, 73.6% of the children identified with middle ear disorders would not have been identified by the use of puretone screening alone. Otoscopy requires an experienced examiner to be highly effective. It would appear that a combination of tympanometry and otoscopy are most efficient for identifying middle ear disorders. Information provided by puretone testing is particularly important for educational management.

Otitis Media, Hearing Loss and School Acoustics

Dobie and Berlin (1979) reported that otitis media is typically accompanied by a mild hearing loss of approximately 25dB HL. The hearing loss is described as being temporary and fluctuating, tending to vary in severity over the course of the disease. Fria et. al. (1985) studied the hearing loss associated with otitis media in 762 children, aged 7 months to 12 years. They reported that 50% of the ears tested had puretone averages poorer than 23dB HL and 20% exhibited puretone averages greater than 35 dB HL.

These problems would be intensified in the average school classroom. Skinner (1978) notes that the background noise surrounding listeners is typically 10 to 15 dB below that of an incoming speech signal. Adults who are familiar with the language cope with this interference quite well, being able to use contextual cues to fill in when the acoustic signal is unclear. Young children who are not yet sophisticated language users (such as those with histories of otitis media) need a greater difference, closer to 30 decibels between the background and speech signals. However, studies (Sanders, 1965) on the acoustic characteristics of kindergarten and elementary classrooms showed that the levels of background noise ranged from only 1 to 5 dB below the speech signal. "Open" classroom situations were found to have background noise which at times exceeded the speech signal of the teacher by as much as 6 dB. This disadvantage is even greater when placed in an "open" classroom.

Otitis Media: Language Development and Educational Effects

Zinkus (1986) explains that there does seem to be "a close relationship between hearing impairment and delayed language development with potential subsequent impaired learning". He goes on to say that persons with impaired hearing typically exhibit lower verbal intelligence scores as compared with normal hearers, even though performance on non-verbal measures may be quite comparable. Zinkus continues "the evidence suggests that normal acquisition of language and verbal intelligence depends greatly on the ability to receive auditory input accurately". The hearing loss which accompanies recurring otitis media would effectively prevent auditory information from being accurately received by the child. He concludes that the fluctuating and recurrent nature of hearing loss associated with middle ear disease could be more disruptive to some listening skills than consistent hearing loss. A number of studies have been reported which appear to support these contentions.

In reviewing studies regarding the integrity of the auditory pathways, Downs (1988) suggests two tentative conclusions. She suggests that conductive hearing loss may have greater effect on educational activity than previously thought. She also speculates that the transient hearing loss which accompanies recurrent otitis media may produce the central nervous system like symptoms which are referred to as central auditory processing disorders and language learning problems.

Children with histories of recurrent otitis media beginning in early childhood were compared to a similar group with no history of ear disease by Holm and Kunze (1969). They reported that the two groups differed significantly on a number of auditory and language measures as well as in articulation, with the non-disease group consistently performing above those with histories of otitis media.

Ling (1972) found that children with history of recurrent otitis media presented notable delays in several language based academic areas as compared to a similar group with no such history. Kaplan and colleagues (1973) followed a sample of Eskimo children over a ten year period. Children with chronic middle ear disease were determined to be significantly slower

than children without otitis media in the development of both words and sentences. Children without recurrent otitis media were found to have higher verbal IQ scores, while nonverbal performance did not differ between the two groups.

Zinkus et. al. (1979) conducted a study involving two groups of school children. One group consisted of children with diagnosed central or auditory processing deficits. The other group consisted of learning disabled children with no recognized auditory problems. Among the findings reported were that significantly more of the children in the auditory processing deficit group had experienced recurrent otitis media (46.3% compared to 22%). The group with auditory processing disorders had significantly lower verbal IQ scores than those in the non-auditory deficit group. In addition, differences were found between the behavioral characteristics of the two groups with the auditory deficit group displaying more deviant behaviors in the learning situation. Although no direct link could be established between recurrent otitis media and the differences between these two groups of students, Zinkus and colleagues concluded that recurrent ear disease may be an important factor in these findings.

In a subsequent study (Zinkus and Gottlieb, 1980) children with auditory processing disorders accompanied by histories of recurrent otitis media were found to exhibit delayed development of one-word vocabularies and three-word phrases than children who lacked such a history. The children in the otitis media group were found to have greater difficulties in auditory discrimination, auditory memory, and the analysis of auditory material, with severity of the disease found to correlate highly with severity of the disorder.

The academic achievement levels of children who had experienced early recurrent otitis media were assessed by Howie (1979). Results showed that children in a matched control group scored higher on the achievement measure than students with histories of otitis in the early years, even though testing was administered in grades three and six.

The list of studies continues to grow as more and more researchers and educators attempt to fully understand the relationship between otitis media and learning. Silva et. al. (1986) reported continuing hearing deficits in addition to language, speech, behavioral and academic problems among a group of children with histories of otitis media studied longitudinally. Schlieper et. al. (1985) assessed two carefully matched groups of three-to five-year olds on several language and speech measures. The tests were readministered after one year. In both cases, the children differed significantly on the majority of measures, implying that children who experience recurrent otitis media are "at risk" for language disorders or delay.

Freeman and Parkins (1979) looked at children with diagnosed learning disabilities. They found that 24% of these children had abnormal tympanometry as compared to 8% among a matched control group. Audiometric evaluation showed that the learning disabled group failed a 20-25 dB screening approximately six times more often than the controls. Research by others (Masters and Marsh, 1978) has supported the findings that learning disabled children evidence increased incidence of middle ear disorders.

Hasenstab (1987) notes that not all of studies assessing the effects of otitis media on educational success have produced clear cut results. She presents several examples. Howie et. al. (1979) compared children who had experienced three or more episodes of otitis media prior to the age of 18 months with children having a negative history of otitis. Their results yielded no differences for mean achievement scores, reading, language arts, or mathematics. Despite the lack of differences noted, a lower overall composite score was achieved by the children in the otitis media group. Similarly, Brandes and Ehinger (1981) and Sak and Rubin (1982) failed to find significant differences in academic achievement between students with positive histories of otitis media and those without. The latter study compared children with recurrent otitis media with an unaffected sibling. Both groups tested in the bright-normal range of intelligence and had no diagnosed learning disabilities. Even though no significant differences in achievement were found, the group with recurrent otitis media did show deficits in verbal ability, auditory decoding, and spelling skills as compared to the unaffected group.

Hasenstab goes on to suggest that differences exhibited by children may be caused by alternative learning strategies that children develop in order to compensate for deficits. The measurements used by these studies to assess the effects of middle ear disease may be too gross to identify what might be extremely subtle differences. She concludes that "although some children with history of recurrent otitis media may appear equal to nonaffected peers for specific achievement measures, their deficits may be manifest in more elusive areas not tested by current instrumentation". A study currently being conducted by Hasenstab and Butts at the Medical College of Virginia appears to be supportive of this hypothesis.

This study is comparing the results on several measures of five-to six-year old children with no history of recurrent otitis media with a group exhibiting the disease process prior to age 12 months. The children were tested with a battery of tests, including measures of central auditory processing and communicative competence measures.

Preliminary analysis of data on 28 affected and 10 unaffected children has shown a number of differences. Although measures of cognitive abilities, general communication aspects, and holistic processing were average to above average in the affected children, the children exhibited wide variation in memory and sequential task abilities. Hasenstab concludes that based on the preliminary data analysis, early recurrent otitis media interrupts a child's auditory learning patterns. These children appear to continue the learning process in spite of the interruptions, but must develop compensatory learning styles, resulting in altered problem solving strategies. Thus, even children who appear to be achieving at normal levels may be exhibiting this degree of skill due to the development of compensation strategies.

In addition to the impact on language and academic development, otitis media has been associated with behavioral differences. Gottlieb et. al. (1979), McGee, Silva and Stewart (1982), and Silva et. al. (1982) suggest that hyperactivity, inattention, distractibility, disruptive actions, and

withdrawal are behaviors found to be associated with recurrent otitis media, particularly in males. These behavior patterns can significantly interfere with the child's language, learning and social development.

While a causal relationship between recurrent otitis media and deficits in language learning or education achievement has yet to be fully established, the evidence indicates the serious potential impact of otitis media. Some students who experience recurrent otitis media are clearly "at risk" for language and academic problems. Therefore, it is necessary to identify and treat the disease in school children as a precaution against possible long term scholastic effects.

RECOMMENDATIONS OF THE TASK FORCE

As a result of the information gathered for this report, the Task Force recognizes and supports an aggressive program designed to identify and accommodate the presence of mild conductive hearing loss in Virginia's public school children. The following are the specific recommendations of the task force:

1. A statewide comprehensive hearing conservation program should be established to provide hearing health care services to children served by the school systems of Virginia.

   Discussion

   That hearing loss has detrimental effects on school performance has been recognized for many years. It has been stated that hearing screening is one of the oldest and most widely completed form of health screening in public schools. The current most widely used practice is the use of puretone audiometric screening used alone as the only tool for screening. However, the use of puretone screening procedures alone miss potentially half of the children experiencing hearing disorders. Otitis media with effusion may cause hearing loss of 20 to 30 dB. This level of hearing impairment has been shown to have detrimental effects on speech perception, and studies have shown that there is strong evidence that the mild fluctuating hearing loss which accompanies middle ear effusion has a negative impact on learning. Yet, in most screening programs, 25 dB is the accepted level for passing the screening. The addition of a procedure intended to screen for middle ear disorders, is needed in the state. Without routine use of such a procedure, many children with educationally damaging degrees of hearing loss will be missed.

   The addition of a new screening tool will require education and training on several levels if the program is to be fully effective. Adequate training must be provided for those persons who are responsible for coordinating and carrying out local screening programs. Parents and local medical referral sources must be educated on the purposes and importance of the new procedures. Finally, teachers must be in-serviced on how to manage these children educationally during periods when the child is experiencing related difficulties in the classroom. All of these aspects must be used together in a comprehensive program.

2. A comprehensive hearing conservation program would consist of identification, referral, in-service education for teachers, and involvement of parents and members of the local medical community.

   Discussion

   If a hearing screening program in the schools is to be comprehensive and designed to identify and assist all children with hearing disorders which may interfere with optimal learning, that program must include identification procedures which will identify the largest number of students with hearing disorders, and identify students with both sensorineural and/or conductive hearing impairment. Puretone

screening is a well established and effective method of identifying children who need further evaluation for sensorineural and in some cases conductive hearing loss. It is undeniably an important part of an identification program. Since the purpose of a screening is to identify those children in need of further evaluation, procedures such as bone conduction and audiometric speech testing should be conducted in follow-up evaluations and are not appropriate in screening procedures.

Tympanometry is the most sensitive, accurate and easy to use procedure for identifying children with middle ear disorders. Use of the acoustic reflex has been found in several studies to result in significant numbers of overreferrals while puretone procedures miss many middle ear disorders. It appears that tympanometry used by knowledgeable testers, with carefully chosen referral criteria is the most appropriate measure for identification of middle ear problems in school children.

Although many students with middle ear effusion may exhibit spontaneously resolving effusion, over a period of two to three months, that child may well be experiencing difficulty in the educational setting, the cause of which is not readily apparent to either the child or the teacher. An awareness of the potential effects, and signs to be aware of in children with recurrent effusion by teachers, parents and other school personnel is of great importance. During the period of time when the resolution is occurring, the child should be provided with compensatory strategies to optimize his learning situation.

A final important aspect which must be addressed in a comprehensive hearing screening program concerns follow-up. The purpose of a screening has been stated as identifying children in need of follow-up evaluation. If no mechanism is provided to ensure that follow-up occurs and recommendations are followed, the program is rendered essentially useless. The lack of personnel and time for ensuring adequate follow-up was frequently mentioned by school personnel as their biggest concern regarding current screening practices. Specific procedures and personnel must be designated to ensure follow through.

In summary, a comprehensive hearing conservation program should include the following:

I. Identification Procedures:
   - puretone air conduction screening
   - tympanometric screening

II. Referral Procedures
   - appropriate pass-fail criteria
   - appropriate referrals
   - adequate follow-up

III. Educational Procedures
teachers
parents
medical personnel

3. It is recommended that the Supervisor of Health Services be responsible for coordinating the program at the state level, in cooperation with the Supervisor of Speech-Language, and Hearing Impaired Programs.

Discussion

A central person at the state level is needed to monitor the activities of local educational agencies as well as to serve as a resource person as localities begin to set up expanded programs. Continuity across local educational agencies in screening protocols is desirable and is best achieved through central coordination. Since the Supervisor of School Health will be in close contact with designated local coordinators, this individual is felt to be the appropriate state level coordinator. An Advisory Committee should be appointed to assist in the development and implementation of a comprehensive state-wide hearing screening program.

4. It is recommended that a person be identified in each local education agency who is to be responsible for coordination of the hearing screening program at the local level. This person should be responsible for execution of in-service and educational programs and implementation of referral and follow-up procedures.

Discussion

It is similarly important to identify a central person within each school division to coordinate the program. This will insure that screening procedures are valid and reliable, and that follow-up of the students failing the screening program is completed.

5. It is recommended that audiologists, registered nurses, and/or speech-language pathologists be responsible for on site supervision and execution of puretone and tympanometric screening. These persons must have expertise in the administration and interpretation of puretone and tympanomtric screening. Such training should be completed by an audiologist, and conducted in a uniform manner by the Department of Education. The use of speech-language pathologists should not cause cancellation of therapy services for any identified speech-language impaired students. Other staff may be used as needed, following proper training, and with a previously identified specialist on-site.

Discussion

The successful administration of the described hearing screening programs requires sufficient technical knowledge of tympanomtric screening procedures and interpretation. Statewide training will insure consistency of assessment referral and follow-up.

6. It is recommended that the state provide start-up funds to all local education agencies to initiate a comprehensive hearing screening program.

Discussion

A) This should amount to a grant of $3,000 for the purchase of 1 tympanometer for every 1,000 students in grades K, 1, 2 and 3, and all preschool handicapped students. This would not supplant tympanometers the school divisions currently own. This should amount to a total equipment cost of approximately $750,000.

B) Start-up costs should also include intensive training of school divisions in executing hearing screening programs. Initial training costs of $75,000 should be funded. This should include personnel to complete hands-on training, and development of a "trainer of trainers" manual for audiologists.

7. It is recommended that screening be provided to students as follows:

Puretone Screening:
-all students in grades K, 3, 7 and 10
-all new students
-all students referred to the Child Study Committee and/or special education supervisor
-preschoolers identified in Child Find procedures
-any student referred by the teacher
-any student failing tympanometry
-all students failing in previous years

Tympanometry
-all students in grades K-3
-all students referred to the Child Study Committee and/or special education supervisor
-all new students in grades K-3
-any student referred by the teacher
-preschoolers identified in Child Find procedures
-all students receiving special education services
-all students failing in previous years

Discussion

Because the purpose of a screening is to identify children who have conditions which require further evaluation, screening procedures need not be applied to children in whom conditions are known to be present. Due to the nature of sensorineural hearing loss, once a child is identified as having such a loss, screening procedures are no longer appropriate. Such a child will instead require periodic reevaluation.

It is recognized that early identification and intervention is desirable for hearing impaired children. Thus screenings should be implemented at the earliest possible opportunity. Any preschooler with which a system is involved should be evaluated for hearing difficulties. Within the public schools, the earliest possible

opportunity is typically at the kindergarten level. It is unlikely that if a child is found to have normal hearing in Kindergarten that a sensorineural hearing loss will be evident by Grade 1. It is possible that some types of progressive losses may begin to manifest themselves in the early school years. Thus, an additional screening in grade 3 is seen as advisable. Grade 7 is seen as a transition year into high school and as such everything possible to ensure maximal success at that level, including hearing screening, should be completed. Finally, it was recommended that students should have a hearing test prior to finishing high school. At this age it is important to screen for the presence of noise induced hearing loss. Tenth grade was seen as optimal since the student is in his/her last year of health and physical education thus ensuring availability for screening procedures.

For the most part, other changes in hearing experienced by school age children will be conductive in nature and are more likely to be identified through tympanometric procedures. It appears that the prevalence of middle ear disorders is greatest in preschool children, and that very possibly the greatest effects are seen in children who suffer early recurrent otitis media. Efforts should be made toward reaching these children whenever possible. In school age children, the incidence of otitis media decreases as the child progresses beyond the primary grades. Studies show that a significant decrease in incidence occurs between the third and fourth grade years, with grades K-3 showing similar incidence figures. Therefore all children in grades K-3 should participate in tympanometric screenings yearly. All special education referrals must continue to be assessed for integrity of hearing. Students with past history of failures should be annually rescreened to monitor their follow-up medical care and provide input to both the medical and educational personnel working with the students.

8. All Kindergarten and new students must be screened within the first sixty days of a school year. Hearing screenings involving puretone and tympanometry should be conducted for all students being assessed to determine eligibility for special education immediately following referral to the supervisor of special education. Early screening allows sufficient opportunity within the 65 day timeline. The time line for all other screenings and referrals is to be decided by the local educational agency.

Discussion

The importance of knowing the hearing status of students cannot be over stated. Development of appropriate education programs relies on accurate knowledge of the student's hearing. Unfortunately, the physician's report (Form MHC 213 B.), as completed, frequently does not contain current information about the status of the child's hearing. Therefore, the minimal time and expense of Kindergarten screening is warranted to determine current hearing status.

9. Certain protocols are recommended for screening procedures to insure greatest validity and reliability of screening results.

I. Puretone Screening:

1. Screening levels

1000 Hz	25 dB
2000 Hz	25 dB
4000 Hz	25 dB

2. Failure would be constituted by failure to respond at any frequency at the designated level in either ear.

3. Any child failing would receive a second screening prior to referral. All children receiving puretone screening will also be receiving tympanomtric screening. Results should be coordinated.

4. Failure on two screenings would require physician referral/audiometric evaluation beyond screening.

5. Puretone hearing screening procedures must take place in a quiet, preferably isolated environment.

II. Tympanometric Screening

1. Referral for a rescreen would be based on the following criteria:

   - compliance equal to or less than .2mm
   - pressure less than -200 daPa
   - excessive volume

2. Rescreening would occur at least 7 and not more than 45 days after the first screening, with 3 to 4 weeks following being the optimal waiting period.

3. Referral for medical screening would follow failure of a second screening using the following criteria:

   - compliance equal to or less than .2mm
   - pressure less than -200 daPa
   - excessive volume

   The parents should be informed of screening results and referred to their primary hearing health care provider. It is recommended that this professional have the equipment and expertise to complete the following: audiological and tympanometric assessment, and otoscopic examination with magnification.

4. Following the second screening, students would be identified as "at risk" and such information passed on to teachers so that compensatory measures could be initiated. Placement of the student on an "at risk" list would be based on the following criteria:

   - compliance equal to or less than .2mm

   - pressure less than -275 daPa

   - excessive volume

   The value of -275 daPa was found to be most effective in reducing over-referrals for medical evaluations during Project HEAR.

5. Tympanometric screening does not require consideration of test environment noise levels. Since it is not a test of "hearing" and does not require a response from the student, the test environment is not crucial as with puretone testing.

   Discussion

   Audiometric criteria and procedures were taken from the Guidelines for Audiometric Services in the Public Schools as it was felt that those recommendations were carefully considered and presented. Puretone Screening at 500 Hz was omitted due to the poor validity of this measure (high false positives due to external noise). Identification of low frequency hearing loss (which is usually identified by screening at 500 Hz) is accomplished via tympanometry. Tympanometric criteria were selected based on the criteria selected by the several programs discussed earlier. Based on procedures used by Project HEAR in which a pressure reading of less than -200 daPa, was used, it appears that the false positive rate could be lessened significantly by lowering the pressure reading to -275 daPa as a referral criterion. However, it is felt that a negative pressure reading of less than -200 daPa should be rechecked for either resolution or worsening of the condition following the first screening, and that persistent pressure of this level should constitute an "at risk" factor.

   It is felt to be necessary that two screenings be completed prior to medical referral to increase validity and therefore prevent overreferral.

10. The types of equipment purchased for school screening purposes meet certain criteria.

I. Puretone Screening

Any calibrated puretone audiometer capable of testing at the suggested levels and frequencies is felt to be adequate.

II. Tympanometry

1. The equipment with digital circuitry is preferable.

2. All equipment within a given school division should be of the same type.

3. Equipment should have a visual display.

4. The equipment should be capable of producing a hard copy printout.

5. There should be approximately 1 back-up unit for every three to four units in a program.

6. Equipment may be purchased as either a tympanometer alone, or as a combined audiometer and tympanometer.

Discussion

Equipment with digital circuitry provides the speed necessary to do testing in the short time span necessary for mass screening. Purchasing equipment of all one type within a local educational agency or region would enable any potential tester to work with the equipment without having to become reacclimated with each new piece of equipment.

Hard copy printouts are desirable for later reference and for providing additional information to the referral physician. The availability of back-up units is vital to an efficient program. During periods of heavy use, equipment failure can destroy a program. Precautions should be taken against such a possibility. There are benefits and drawbacks with each type of machine. The use of two different pieces of equipment allows both puretone and tympanometric screening to be conducted concurrently. In addition, if equipment failure occurs, with the combined unit neither portion of the screening can be continued unless back-up is readily available. Use of the combined piece of equipment reduces the inconvenience of moving both pieces from school to school.

11. A two phase in-service training program be included as part of a comprehensive hearing screening program. Such an in-service program should include (1) training screening participants and (2) informing teachers of the effects of hearing loss on language and learning and of the accommodations which can be made to accommodate the hearing loss.

12. Referral and follow-up should be monitored by the designated program coordinator.

Discussion

Unless follow-up occurs for children identified, a program such as the one proposed here would be of no value. It is very often the case that the child who most needs the attention is the one for whom no follow-up of a medical referral takes place. Medical referral to the child's primary hearing health care provider, is recommended. School divisions may also consider the value of contracting with specific physicians for follow-up. It is deemed necessary that one person be specifically charged with following referrals to ensure that proper action is taken. In addition to parents, classroom teachers must be notified of the child's status so that classroom management will occur. Students failing hearing screening should be considered "at risk" for learning. A division may choose to refer the child to the Child Study Committee for consideration of necessary teaching modifications and/or referral for special education. The failure to comply with follow-up for students not referred for special education on the part of the parents should be aggressively investigated by division personnel, with possible consideration of referral to the Department of Social Services for medical neglect as a last resort.

13. Children "at risk" should <u>not</u> be placed in open classrooms due to the high noise levels present in these settings.

Discussion

The increased noise levels found in "open" classrooms multiplies the effect of hearing loss for the "at risk" student. Placement in a relatively quiet classroom without excess noise and reverberation will maximize the child's learning potential.

14. Form "MHC 213 B: School Entrance Physical & Immunization Certificate" should be revised to require evaluation of hearing, to ensure that hearing is normal following assessment. The form should also cue the physician to report a history of otitis media.

Discussion

Minor revision to the form can ensure that hearing is assessed for each student prior to entrance into schools or review for special education eligibility.

15. Form "LF.011: Summary of Physical Defects and Corrections" should be revised to specify the nature of the "ear deficit".

Discussion

Allowance for greater specificity with respect to "ear deficit" (conductive or sensorineural hearing loss) and "corrected" (referral to health care provider, hearing aids) will allow an increased accuracy of follow-up of hearing screening programs.

GLOSSARY

Terms Related to Otitis Media

Otitis Media: a general term used for inflammation in the middle ear cavity. Current approaches to diagnosis have produced more specific terminology as defined below.

Acute Otitis Media: an active inflammation and/or infection of the middle ear of recent onset or resurgence. This condition is characterized by bulging and/or evidence of pus behind the eardrum. Acute otitis media results frominfection of fluid which has accumulated in the middle ear space as a result of eustachian tube dysfunction. Acute otitis media may spontaneously resolve, or progress into otitis media with effusion or chronic otitis media.

Serous Otitis Media: the presence of uninfected fluid in the middle ear space, and occurs in the early stages of eustachian tube obstruction.

Secretory Otitis Media: the presence of a thick fluid resulting from chronic inflammation resulting in mucus production in the lining of the middle ear space.

Otitis Media with Effusion: the presence of fluid in the middle ear with an absence of definitive signs of acute infection. This term is frequently used interchangeably instead of either serous otitis and secretory otitis when the presence or absence of infection has not been clearly determined.

Chronic Otitis Media: infection of the middle ear with purulent fluid which persists beyond the period oftime associated with acute otitis, and may persist in spite of treatment. This condition may be accompanied by a perforation of the eardrum through which constant drainage of the infected fluid occurs, and generally occurs as a result of inadequate treatment or failure of acute otitis to resolve spontaneously.

Recurrent Otitis Media: a situation in which middle ear infections occur repetitively, perhaps four or five times during a six month period. Periods of resolution exist between periods of infection, distinguishing recurrent otitis from persistent otitis.

Persistent Otitis Media: a condition in which the middle ear space continues to contain fluid following an episode of acute otitis. Fluid may be present in the middle ear for as long as three months following an acute infection.

Appendix A

PROJECT HEAR:

IN-SERVICE TOPICS

PROJECT HEAR: TEACHER IN-SERVICE

I. Properties of Sound/How We Hear

II. Basic Anatomy and Physiology

III. What is Hearing Loss
- A. Nature of Hearing Loss
- B. Types of Hearing Loss

IV. Prevalence of Hearing Loss Among School Children

V. Otitis Media
- A. Definitions
- B. The Otitis-Prone Child

VI. Consequences of Otitis Media
- A. Permanent vs. Fluctuating Hearing Loss
- B. Physical Problems
- C. Academic Problems
- D. Speech and Language Problems
- E. Behavioral Problems
- F. Auditory Processing Deficits

VII. Goals of Hearing Screening Program
- A. Protocols
- B. Follow-up
- C. Referrals

VIII. Tympanometry

IX. Medical Management

X. Educational Management
- A. Environmental Modifications
- B. Compensatory Teaching Strategies
- C. Behavior Management
- D. Assistive Listening Devices

PROJECT HEAR: IN-SERVICE FOR SCREENING PARTICIPANTS

I. Conductive Hearing Loss
   A. Anatomy and Physiology
   B. Definitions
   C. Causes
   D. Degree of Impairment
   E. Consequences
   F. Prevalence

II. Overview of School Screening Programs
   A. Puretone Screening
   B. Audiograms
   C. Tympanometry
   D. Rationale for Screening Programs
   E. Virginia State Regulations

III. Problems Encountered in School Screenings
   A. Overreferrals
   B. Flow of Information
   C. Follow-up
   D. Record Keeping
   E. Calibration
   F. Support for the Program
   G. Costs

IV. Benefits of Hearing Screening
   A. Identification of Hearing Loss
   B. Differential Diagnosis
   C. Appropriate Educational Management
   D. Appropriate Referrals
   E. Awareness of Hearing Loss

V. Elements of an Ideal Hearing Screening Program
   A. Population Served
   B. Initial Screening
   C. Appropriate Educational Management
   D. Education and Habilitation
   E. Counseling

VI. Project HEAR Protocol

VII. Introduction to the Immittance Bridge
   A. Operation
   B. Care/Maintenance
   C. Calibration

Appendix B

PROJECT HEAR:

COST ANALYSIS

Appendix B
Project HEAR Costs
(one complete cycle of services)

	CONSULTANTS' FEES	CONSULTANT: TRAVEL AND LODGING	ENT HONORARIUM (Proportioned by # of students screened)	CLINIC ASSISTANTS	SECRETARY COMPUTER	GRAND TOTAL OF SERVICES	NUMBER OF STUDENTS SCREENED	COST OF SCREENING PER CHILD
Frederick Screening 1	900	383	--	--	--	1,283	2211	.58
Screening 2	338	197	--	--	32	567	684	.83
ENT Screening	125	22	1,020	--	--	1,167	348	3.35
TOTALS	1,363	602	1,020	--	32	3,017	3,243	
Winchester Screening 1	900	383	--	150	--	1,433	1,049	1.37
Screening 2	338	197	--	50	32	617	293	2.10
ENT Screening	125	22	360	--	--	507	122	4.16
TOTALS	1,363	602	360	200	32	2,557	1,464	
Warren Screening 1	575	202	--	--	--	777	1,186	.66
Screening 2	250	117	--	35	--	402	438	.92
ENT Screening	125	24	480	--	--	629	164	3.84
TOTALS	950	343	480	35	--	1,808	1,788	
Clarke Screening 1	575	202	--	--	--	777	480	1.62
Screening 2	250	117	--	25	--	392	130	3.01
ENT Screening	125	24	140	--	--	289	46	6.28
TOTALS	950	343	140	25	--	1,458	656	
OVERALL TOTALS	4,626	$1,890	$2,000	$260	$64	$8,840	$7,151	$1.24

Appendix C

PROJECT HEAR:

PASS-FAIL STATISTICS

PROJECT HEAR: PASS-FAIL STATISTICS

FIRST YEAR

	INITIAL SCREENING					SECOND SCREENING					ENT SCREENING*				
Division	Total Screened	Pass	% Pass	Fail	% Fail	Total Screened	Pass	% Pass	Fail	% Fail	Total Screened	Pass	% Pass	Fail	% Fail
Clarke	476	330	69%	146	31%	158	77	49%	81	51%	83	49	59%	34	41%
Warren	1084	735	68%	349	32%	323	156	48%	167	52%	179	102	57%	77	43%
Frederick	2209	1828	83%	381	17%	456	267	58%	189	42%	176	95	54%	81	46%
Winchester City	1076	892	91%	184	19%	172	93	54%	31	46%	67	36	54%	31	46%
TOTALS	4,845	3,785	79%	1,060	21%	1,109	593	53%	516	47%	505	282	56%	223	44%

NOTE: The number of students screened and failed from previous screenings fluctuate due to student absences and transfers.

* ENT = ear, nose and throat

PROJECT HEAR: PASS-FAIL STATISTICS

SECOND YEAR

Division	INITIAL SCREENING					SECOND SCREENING					ENT SCREENING				
	Total Screened	Pass	% Pass	Fail	% Fail	Total Screened	Pass	% Pass	Fail	% Fail	Total Screened	Pass	% Pass	Fail	% Fail
Clarke	480	365	76%	115	24%	130	74	57%	56	43%	46	28	61%	18	39%
Warren	1186	842	71%	344	29%	438	246	56%	192	44%	164	93	57%	71	43%
Frederick	2211	1598	72%	613	28%	684	355	52%	329	48%	348	209	60%	139	40%
Winchester City	1049	806	77%	243	23%	293	154	53%	139	47%	122	55	45%	67	55%
TOTALS	4,926	3,611	73%	1,315	27%	1,545	829	54%	716	46%	680	385	57%	295	43%

NOTE: The number of students screened and failed from previous screenings fluctuate due to student absences and transfers.

PROJECT HEAR; PASS-FAIL STATISTICS

THIRD YEAR

Division	INITIAL SCREENING					SECOND SCREENING					ENT SCREENING				
	Screened	Pass	% Pass	Fail	% Fail	Total Screened	Pass	% Pass	Fail	% Fail	Total Screened	% Pass	Pass	Fail	% Fail
Warren	1256	1023	82%	233	18%	315	154	49%	161	51%	124	46	37%	78	63%
Clarke	521	428	82%	93	18%	106	54	51%	52	49%	46	20	43%	26	57%
Winchester	1065	886	83%	179	17%	208	96	46%	112	54%	81	27	33%	54	67%
Frederick	2350	1929	82%	421	18%	481	222	46%	259	54%	237	102	43%	135	57%
TOTALS	5,192	4,262	82%	926	18%	1,110	526	48%	584	52%	488	195	39%	293	61%

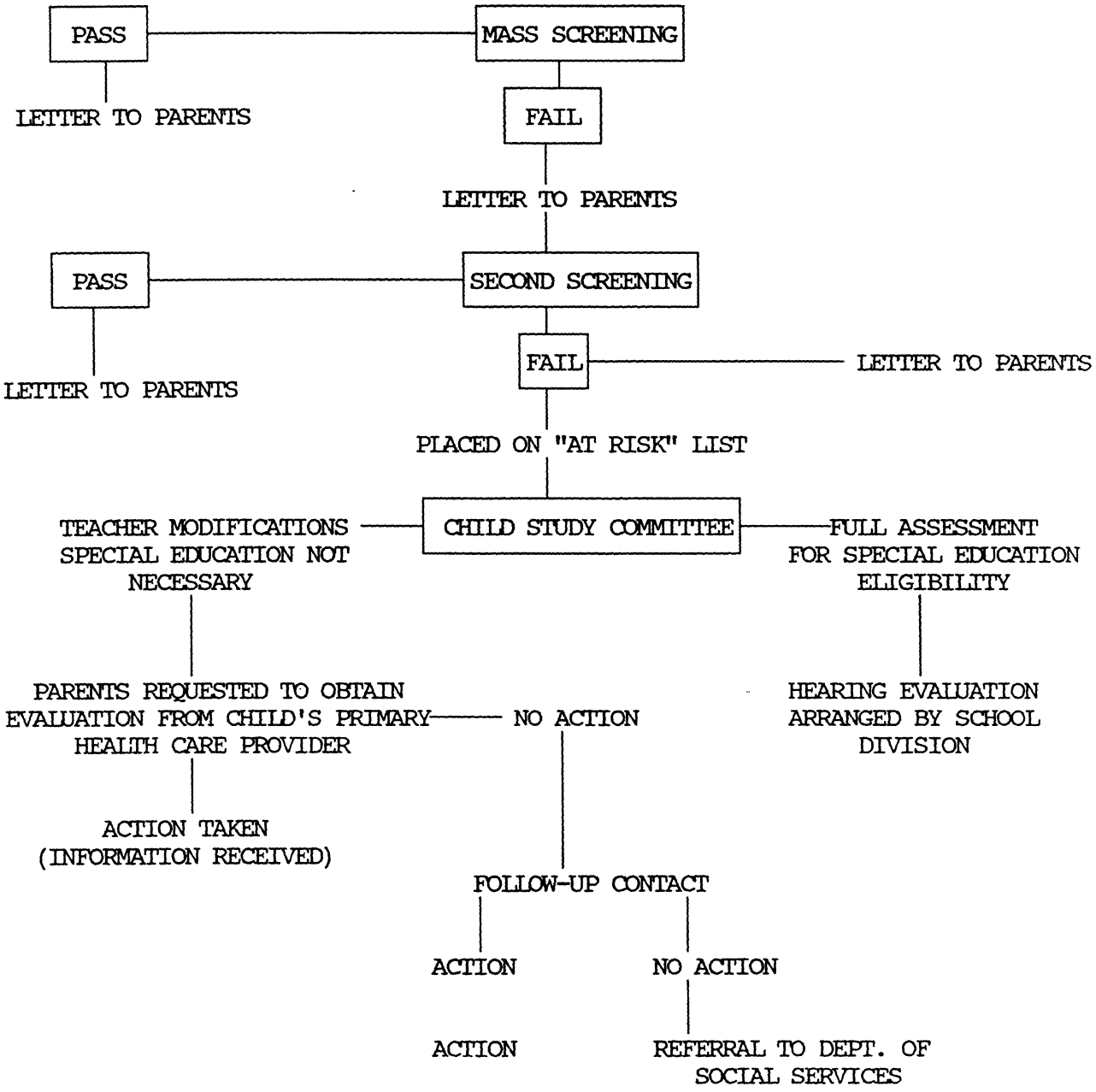
NOTE: The number of students screened and failed from previous screenings fluctuate due to student absences and transfers

Appendix D

RECOMMENDED HEARING SCREENING

FOLLOW-UP PROCEDURES

RECOMMENDED FOLLOW-UP PROCEDURES



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