

## Survey of Hearing Screeners: Training and Protocols Used in Two Distinct School Systems

**Cynthia McCormick Richburg**  
*Indiana University of Pennsylvania*  
*Indiana, PA*

**Laurel Imhoff**  
*Aurora Audiology & Speech Associates*  
*East Aurora, NY*

**This study compared the training and protocols used by two groups of elementary school hearing screeners: one group of school nurses and one group of contractually hired personnel. The participants were asked to complete a survey concerning their training, screening protocols, and opinions on minimal hearing loss (MHL). Results revealed that the school nurses listed more sources of training and reported a greater variation in hearing screening protocols, while the contractual screeners listed fewer training sources and used more uniform screening protocol. Possible reasons for these differences are given, and comparisons on other survey items, including opinions on MHL, are discussed.**

### Introduction

It has long been determined that children identified with hearing loss through screening procedures receive earlier, more appropriate interventions that help them achieve more age-appropriate speech/language, academic, and social levels, while children who are not identified through screenings continue to fall behind their peers in these areas (West & Harris, 1983; Tharpe & Bess, 1991, 1999). Yet, even with hearing loss lending itself so readily to hearing screening programs, there are no national or, in some cases, state regulations for mass school-based hearing screening programs (Johnson, Benson, & Seaton, 1997a). Several entities have proposed general guidelines and procedures (Roush, Bess, Flexer, Gravel, Margolis, Northern, et al., 1997; ASHA, 1997; Missouri Department of Health and Senior Services, 2004); however, guidelines are only recommendations and include no specific rules that have to be followed.

ASHA's Guidelines for Audiologic Screening (1997) contain a section specific to the screening of hearing in school-aged children. The document outlines protocol for testing pure-tones at three frequencies: 1000, 2000, and 4000 Hz. The recommended criterion intensity level is 20 dB HL, and children need to respond reliably to each tone at this intensity in both ears in order to pass the

screening. If a child does not respond to any of the test frequencies in either ear at the ASHA recommended criterion level, it is appropriate to reinstruct the child, reposition the earphones, and conduct an immediate re-screening.

There are several procedures that are not recommended by ASHA. For instance, it is never appropriate to adjust the pass/fail criteria to compensate for a poor testing environment. It has been found that "many [screening programs] appear to screen at higher levels, presumably to compensate for excessive ambient noise levels" (Roush, 1992, p. 306). Screeners, however, should avoid changing the criterion intensity level if the screening room has high intensity background noise levels. Changing the criterion might seem to correct for a noisy environment, but children who have borderline or minimal hearing loss (MHL) might not be identified due to this seemingly small procedural change (Kaderavek & Pakulski, 2002). A student with MHL (hearing in the 16-25 dB HL range) might legitimately fail at 20 dB HL and just as legitimately pass at 25 dB HL. Therefore, screenings should be relocated to a quieter room or completed on a different day. ASHA's list of inappropriate procedures also includes: using speech stimuli, nonconventional instrumentation (hand-held audiometers), uncalibrated signals, group

screenings, and otoacoustic emission (OAE) testing.

In addition to providing guidelines for screening protocols, ASHA (1997) indicates that screeners should either be appropriately credentialed audiologists and speech-language pathologists or personnel supervised by a certified audiologist. In general, it is not cost effective for audiologists to actually administer the screening tests, not to mention the fact that there is a shortage of educational audiologists in school systems throughout the United States (Johnson et al., 1997a). Technicians and volunteers are considerably less expensive and more easily accessible. Therefore, state guidelines for hearing screenings often indicate that school-based screening programs are conducted by a variety of personnel, including "school nurses and medical technicians" (Pennsylvania Department of Health, 2001), "speech-language professionals" (Missouri DHSS, 2004), and "trained volunteers" (Colorado Department of Education, 2001; Missouri DHSS, 2004). Volunteers should be allowed to conduct the initial pure-tone procedure only after receiving "appropriate training and instruction" on the screening forms, procedures, and equipment (ASHA, 1997; Missouri DHSS, 2004). What constitutes appropriate training and instruction is not specified, however, several state guidelines (Louisiana Department of Education, 2007; Missouri DHSS, 2004; Pennsylvania Department of Health, 2001) indicate that the school nurse is often the primary professional involved in screenings. Likewise, Johnson et al. (1997a) recognize nurses as effective professionals for conducting hearing screenings because school nurses are likely to carry out and manage the screening program for several years. They also have a significant amount of medical knowledge, particularly concerning the students in their schools. Unlike volunteers, the nurse is present on designated screening days and on regular school days, when re-screenings are administered.

School-based hearing screenings began on the local level as early as the 1930s in some school systems (Indiana Speech-Language-Hearing Association, n.d.), but were not discussed nationally until the 1960s at the National Conference on Identification Audiometry (Darley, 1961; Flanary, Flanary, Colombo, & Kloss, 1999). The conference, which took place in 1961, marked the beginning of mass school-based hearing screenings. During this conference, several goals for the screening programs were established: "(1) identification of even minimal hearing loss, (2) identification of active ear disease, (3) referral of abnormal exams to physicians, and (4) referral for hearing rehabilitation" (Flanary, et al., 1999, p. 96).

By the end of the 1960s, all states had implemented some form of hearing screening in their schools; however, almost 50 years later, many states still do not have mandated screening protocols for schools (Mannina, 1997; Roush, 1992). Roush stated that while "one would expect to find consistent and well-standardized procedures... nationwide surveys have repeatedly shown substantial disagreement on the philosophical as well as procedural aspects of school screening" (p. 306). Several studies demonstrate the inconsistency of screening programs in achieving these goals (Kemper, Fant, Bruckman, & Clark, 2004; McDermott & VanTassell, 1981; Sophocles & Muzzarelli, 1970). These studies found that screening protocols varied widely within the same state, county, and even school district.

Sophocles and Muzzarelli (1970) conducted a survey within the public school districts of Mercer County, New Jersey. They found that there was no uniformity in the grades screened, frequencies tested, presentation intensity level, or referral method. Two of the school districts did not have a screening program and none of the schools had calibrated audiometers.

McDermott and VanTassell (1981) assessed the need for statewide screening standards in Minnesota by conducting a survey of 195 of the state's school districts. The study was conducted under the assumption that schools throughout the state used uniform screening procedures. The investigators found, however, that this was not the case. One hundred twenty-four school districts used a single combination of levels and frequencies (although the same combination was not used in each school), 15 used two or more combinations of levels and frequencies, 54 districts provided incomplete information, six used a Verbal Auditory Screening for Children instead of a pure tone screening, and one district did not conduct screenings.

In a more recent study, Kemper et al. (2004) showed that lack of consistency in school-based hearing screenings remains a problem in Michigan. The investigators found that there was significant variability in the administration of the screening programs, including the grades screened, services offered to the children who did not pass, and the way in which parents were informed about the screenings.

Screenings of the school-aged population attempt to identify children with educationally significant hearing problems. Yet, it has been reported in numerous studies (e.g., Johnson, Stein, Broadway, & Markwalter, 1997b; Bess, Dodd-Murphy, & Parker, 1998; Tharpe & Bess, 1999; Kaderavek & Pakulski, 2002;) that even a mild hearing loss can

have a significant impact on a student's educational achievement. Because of this fact, and because one of the initial goals of the 1961 National Conference on Identification Audiometry was the identification of "even minimal hearing loss," the identification of MHL during hearing screenings needs to be addressed.

Elementary school hearing screeners are in the unique position to identify students with undiagnosed hearing loss. However, training, supervision, experience, and personal beliefs of these hearing screeners might affect the identification and referral rates of students with hearing loss, including MHL. The purpose of the present study was to compare the training and protocols used by two groups of elementary school hearing screeners. The first group consisted of elementary school nurses, while the second group consisted of contractually hired screeners. The participants were asked to complete a survey concerning their training, the screening protocols they used, and their opinions on MHL. There were three research questions addressed in this study: (1) Are there differences in training between these two groups of screeners?, (2) Are there differences in the screening protocols used by the two groups of screeners?, and (3) Are there differences in the personal opinions of the two groups of screeners regarding students with minimal hearing loss?

### Method

#### *Participants*

Participants in this study were hearing screeners who conduct hearing screenings in two school systems within the state of Missouri. The first group of hearing screeners consisted of elementary school nurses working in a mid-size metropolitan area (population 151,800), with a single school district containing 38 elementary schools. All of the school nurses were registered nurses (RN). Of the 38 elementary school nurses employed by this school system, 17 nurses completed this survey. This represents 44.7% of the total population of this school system's nurses. This group did not have direct contact with an educational audiologist.

The second group of hearing screeners consisted of contractually hired hearing screeners working in a large metropolitan area (population 1,013,123) containing 28 school districts. Each district has several (e.g., 2-21) elementary schools. All of the contractual screeners were required to hold the minimum of a high school degree. The majority of these screeners, however, were retired teachers with a college degree. Of the 29 contractual screeners employed by this school system, 18 completed the survey (13 hearing screeners, three team leaders, and one coordinator, all of whom conducted hearing screenings). This

represents 62.1% of the total population of this school system's contractual screeners. An educational audiologist trained and supervised the contractual screeners.

Each survey respondent was the primary professional responsible for screening the hearing of elementary school students in grades kindergarten through fifth. The school nurses conducted the hearing screenings for only the elementary school in which they worked. The contractual screeners conducted screenings in a larger number of schools, ranging from two to 80 elementary schools ( $M = 50$ ;  $sd = 22.0$ ).

Participants' experience in their current positions ranged from less than one year to 25 years. In general, the school nurses had fewer years of experience (9 months – 19 years:  $M = 5.6$  years, median = 4 years) than the contractual screeners (2 – 25 years:  $M = 11.2$  years, median = 9 years).

The job responsibilities of the school nurses were varied, with hearing screening being only part of their role as the primary healthcare professional at the elementary schools. The job responsibilities of the contractual screeners consisted almost exclusively of screening the hearing of students. The contractual screeners reported to team leaders, who then reported to a coordinator (an educational audiologist).

#### *Survey Instrument*

A 21-item survey was administered to the participants of this study (see Appendix A). This survey was subdivided into three sections: (a) demographic information, (b) hearing screening procedures used by the respondent, and (c) opinions on MHL. Survey items were designed using a mixed format. The four items covering demographic information were open-ended, asking the respondents to describe their position and length of time in that position. The 13 items in the screening procedures section were either open-ended or closed-ended with an open-ended alternative. The third section of the survey presented four statements on a 5-point Likert scale (1 = strongly agree, 2 = agree, 3 = no opinion, 4 = disagree, 5 = strongly disagree) to identify the participants' level of agreement or disagreement with concepts related to MHL. Space was provided at the end of the survey for the respondents to write comments.

#### **Procedures**

Following IRB approval at the sponsoring university, the investigators contacted three individuals to obtain permission to conduct the study: the Director of Research and Assessment and the Director of Student Health Services in the school system where nurses performed the hearing screenings and the Director of Related Services in the school system that

hired contractual hearing screeners.

The surveys were distributed to the school nurses (left at the front office or handed directly to the nurse) and collected by the investigators. Due to distance constraints, the investigators mailed the surveys to the Director of Related Services for distribution to the contractual hearing screeners. Most of the surveys were collected by the Director and mailed back to the investigators, although some of the respondents opted to mail the survey directly.

Each participant was provided with a cover letter describing the study and asked to respond to the four-page survey. Participants' completion of the survey represented their informed consent to participate in the study. The survey took approximately 15 minutes to complete.

### Data Analysis

As each survey was returned, data were entered into an SPSS program for analysis (Norusis, 1990). Descriptive data, including median, mean, and range of responses, were documented for each group of screeners for each survey item. Chi-square and Cramer's V (tests of goodness of fit) were calculated between the two groups of screeners and their responses to the items concerning screening protocol (Morgan, Leech, Gloeckner, & Barrett, 2004).

There is debate as to whether data obtained through a Likert-type scale should be considered ordinal or interval (Jaccard & Wan, 1996; Morgan et al., 2004; Salkind, 2004). For the purposes of this study, the Likert data were considered to be ordinal, and a Mann-Whitney U test was used for calculations (Morgan et al., 2004).

### Results

#### Survey Questions Regarding Hearing Screening Procedures

The first research question in this study asked, "Are there differences in training between these two groups of screeners?" Item #8 on the survey addressed this research question. Thirteen of the school nurses (72.2%) reported multiple sources (2 to 3) for their training. All seventeen of the contractual screeners (100%) reported that they received their training on hearing screening protocols from an in-service session provided by an educational audiologist. Five contractual screeners (29.4%) listed additional sources of training. The reported sources of training and the percentage of responses are detailed in Table 1.

The second research question in this study asked, "Are there significant differences in the screening protocols used by the two groups of screeners?" Items #7a-f, #11, #12, and #13 on the survey addressed this

Table 1

Reported Sources of Hearing Screeners' Training

Source	School Nurses (%)	Contractual Screeners (%)
School Policy	83.3%	-
State Guidelines	44.4%	-
In-Service	33.3%	100%
Shown Procedure	22.2%	11.8%
ASHA Guidelines	5.6%	-
Other	5.6%	17.6%

Note. Multiple responses were allowed.

research question. These items included questions concerning frequencies, intensities, pass/fail criteria, number of children tested at one time, middle ear screening, use of otoscopy, and re-screening and referral procedures. The responses to these individual items are presented below.

**Frequencies used.** The hearing screeners were asked what frequencies were used during screenings (#7a). Seventeen of the 18 school nurses (94.4%) screened students' hearing using 500, 1000, 2000, and 4000 Hz as test frequencies. One school nurse (5.6%) responded, "200, 400, 800, and 1000."

Fifteen of the contractual screeners (88.2%) used 500, 1000, 2000, 4000 and 6000 Hz as test frequencies. One contractual hearing screener (5.9%) reported using 500, 1000, 2000 and 4000 Hz. One contractual screener (5.9%) reported that she tested 1000, 3000, 5000, and 6000 Hz, but if a student failed two frequencies during the initial screening, she also tested 500 Hz.

A Cramer's V was calculated to determine if the school nurses and contractual screeners differed on which frequencies they tested. This test is more appropriate than a chi-square in the analysis of this data because there is a larger cross tabulation (2x3, not 2x2). The Cramer's V indicated that school nurses and contractual screeners were significantly different in the frequencies that they screened ( $V = 0.914, p < 0.001$ ).

**Intensity levels used.** The hearing screeners were asked what intensity levels they used during hearing screenings (#7b). Five school nurses (27.8%) used 25 dB as the standard intensity level tested, four (22.2%) used 20 dB, and four (22.2%) used "20-25 dB." Three school nurses (16.7%) reported using "20 and up" and one nurse (5.6%) used 20-30 dB. One elementary



school nurse (5.6%) reported using “whatever is needed.”

Fourteen of the contractual screeners (82.4%) used 25 dB as the standard intensity for screenings. The remaining three (17.6%) did not respond to the survey item.

A Cramer’s V again was calculated to determine if the school nurses and contractual screeners differed on which intensities they tested. The Cramer’s V indicated that school nurses and contractual screeners were not significantly different in the intensities that they screened ( $V = 0.712, p = 0.001$ ).

**Pass/fail criteria used.** The hearing screeners were asked what criteria they used for failing a student (#7c). The elementary school nurses gave twelve different responses to this survey item. The most common responses for failure criteria were: “missing two frequencies greater than 30 dB” (16.7%), “after 25 dB” (16.7%), and “no response above 20 dB in either ear at 1000, 2000, or 4000 Hz or above 30 dB at 500 Hz in either ear” (11.1%). The nine other responses for failure criteria can be seen in Table 2.

Fourteen of the contractual screeners (82.4%) reported that missing any two frequencies (at 25 dB HL) was designated a failure. The remaining three contractual screeners (17.6%) did not respond to the question (Table 2).

It was evident without the use of statistics that the twelve responses on pass/fail criteria from the nurses were different in number and in content from the one response given by the contractual screeners. Therefore, no statistical analysis was performed for this survey item.

**Use of otoscopy and tympanometry.** Respondents were asked if they used otoscopy or tympanometry at any point during the hearing screening process (#7e-f). Eleven (61.1%) of the school nurses used otoscopy as part of their re-screening protocol, performing it only on students who failed the initial screening. Five (27.8%) nurses used otoscopy as part of their standard screening protocol. One school nurse (5.6%) never used otoscopy, and one (5.6%) reported that she “sometimes” used otoscopy. None of the contractual screeners reported performing otoscopy during the hearing screening process. Neither the school nurses nor the contractual screeners reported using tympanometry.

**Procedures used following screening failure.**

Three survey items required the screeners to describe the procedures they used for re-screenings and referrals (#11-13). The first item asked the professionals to describe the procedure they followed when a child failed a hearing screening. The second item asked to whom the child was referred, and the

Table 2

*Reported Pass/Fail Criteria for Hearing Screenings*

Criteria	School Nurses	Contractual Screeners
“Missing two frequencies greater than 30 dB”	N=3	-
“After 25 dB”	N=3	-
No response above 20 dB in either ear at 1000, 2000, or 4000 Hz or above 30 dB at 500 Hz	N=2	-
Missing two frequencies in one ear or one in each ear at 30 dB	N=1	-
Any frequency not detected between 25 and 40 dB	N=1	-
Missing two frequencies greater than 25 dB	N=1	-
Missing two frequencies at 25 dB	-	N=14
Referral after 20 dB	N=1	-
Missing two frequencies or missing one frequency at 40 dB or greater	N=1	-
Missing more than one frequency per ear	N=1	-
“>20; >30”	N=1	-
“Two failed tones above 500 Hz at 30 dB”	N=1	-
Not hearing a tone at 30 dB	N=1	-
No Response	-	N=3

third item asked about the actions taken when a child was absent on the screening day.

The school nurses gave 17 responses for the procedures they used following a failed screening (#11). The majority of nurses used similar procedures, but several included additional, less common procedures. Sixteen school nurses (88.9%) reported that they personally conducted a re-screening of students who failed the initial screening; 15 of these nurses reported that the re-screenings occurred one to two weeks later, and one nurse reported that the re-screenings occurred two to three weeks later. Four (22.2%) school nurses reported that they conducted otoscopy and a case history during the re-screening. Additional procedures reported by the school nurses following the screening are included in Table 3.

The contractual screeners provided eight different responses, each with multiple steps. Fourteen (77.8%) reported that the names of students who failed the screening were given to the school nurse, and she re-screened them at a later date. Ten (58.8%) contractual screeners reported that parents were mailed a letter explaining the need for a complete audiologic evaluation. Six (35.3%) reported that any student who failed the screening was immediately rescreened by another contractual hearing screener. One contractual hearing screener (5.9%) reported that the team leader

Table 3

*Additional Procedures Reported by the Nurses Following a Screening Failure*

Procedure	School Nurses
Parent Letter	50%
Referral to Primary Care Physician (PCP)	50%
Referral to "Hearing Specialist"	22.2%
Threshold Search	11.1%
Parent Phone Call	5.6%
Parent Conference	5.6%
Referral to PCP after 3 failures	5.6%
Immediate Referral to PCP if visible fluid	5.6%
Referral to Bureau of Special Health Care Needs or University Audiology Clinic	5.6%
Inform Teacher	5.6%

*Note.* Multiple responses were allowed.

conducted the immediate re-screening. Five (29.4%) responded that the names of students who failed the screening were put on a list that was given to the school system's educational audiology office. Three (17.6%) reported that they referred the student directly to the educational audiology office, and one (5.9%) reported that she referred the child to his or her physician.

**Referral procedures used.** The hearing screeners were asked to whom they referred students who failed the hearing screening (#12). Most of the hearing screeners gave multiple responses. The list of referral sources and the percentage of responses can be seen in Table 4.

**Procedures used for hearing screening absences.** The respondents were asked to describe the procedures they used when a student was absent on the scheduled screening day (#13). Ten of the school nurses (55.6%) responded that they scheduled days for "make-up screenings." Six (33.3%) nurses reported that they individually screened students who were absent in their offices. One school nurse (5.6%), who had less than one year of experience in her current position, reported that she had "not run into this yet." One school nurse (5.6%) did not respond to the survey item.

All (100%) of the contractual screeners responded with the same answer. They stated that the school nurse performed the hearing screening at a later date if a student was absent on the scheduled screening day.

Table 4

*Reported Referral Sources for Hearing Screening Failures*

Referral	School Nurses (%)	Contractual Screeners (%)
PCP	72.2%	23.5%
Local University Clinic	27.8%	-
School Audiology Office	-	58.8%
ENT	11.1%	-
Parent's Choice	5.6%	-
Bureau of Special Health Care Needs	5.6%	-
Specialist	5.6%	-
Audiologist	5.6%	-
School Nurse	-	52.9%
Don't Know	5.6%	-
No Response	5.6%	5.9%

*Note.* Multiple responses were allowed.

### **Survey Questions Regarding Opinions on Minimal Hearing Loss**

The third research question in this study asked, "Are there differences in the personal opinions of the two groups of screeners regarding students with minimal hearing loss?" Items #14 through #17 addressed this research question. The hearing screeners were asked to rate their level of agreement with several statements concerning MHL using a five-point Likert scale. The statements are four of the "myths" from a previous study by McCormick Richburg and Goldberg (2005). A brief definition of MHL was provided to the respondents (see Appendix A).

Five of the 18 elementary school nurses (27.8%) did not respond to the four questions regarding MHL. Likewise, ten of the 17 contractual screeners (58.8%) did not answer any of the items on MHL. Seven of these ten (70.0%) contractual screeners wrote that they were "not qualified" as their reason for not responding to this set of survey items. Two of the contractual screeners in this group of seven added that they were not qualified because they were "not an audiologist," and one screener added that (s)he was not qualified because (s)he had "no expertise." Three of these ten respondents did not provide a reason for not answering the final four survey items. Of the seven contractual screeners who did provide a response, one (14.3%)

answered “no opinion” for each of the four items. The remaining six (6/17: 35.3%) contractual screeners provided responses for these last four survey items. Therefore, all results (percentages) discussed below will be based on only the 13 school nurses and the seven contractual screeners who responded to the four items in this section.

For the statement, *“There is no such entity as minimal hearing loss. In essence, these students have hearing within normal limits,”* eight school nurses (8/13: 61.5%) indicated that they agreed. One school nurse (1/13: 7.7%) had no opinion and, four school nurses (4/13: 30.8%) disagreed with this statement. None of the school nurses strongly agreed or strongly disagreed with the statement.

None of the contractual screeners strongly agreed with the statement and one contractual hearing screener (1/7: 14.3%) agreed with this statement. Three (3/7: 42.9%) had no opinion and two (2/7: 28.6%) disagreed. One contractual hearing screener (1/7: 14.3%) strongly disagreed with the statement (see Figure 1).

A Mann-Whitney U test was used to compare the mean rank responses of the school nurses (9.04) to the contractual screeners (13.21). The analysis did not reveal a significant difference between the two groups ( $U = 26.50, p = 0.11$ ).

For the statement, *“Students with minimal hearing loss will be identified through school hearing screenings,”* one school nurse (1/13: 7.7%) strongly agreed with this statement. Six of the school nurses (6/13: 46.1%) agreed with the statement. One nurse (1/13: 7.7%) had no opinion, and five nurses (5/13: 38.5%) disagreed. None of the school nurses strongly

disagreed with the statement.

One contractual hearing screener (1/7: 14.3%) strongly agreed with this statement, and the majority of the contractual screeners (3/7: 42.9%) who responded to this item agreed with the statement. Two (2/7: 28.6%) contractual screeners had no opinion and one (1/7: 14.3%) disagreed. None of the contractual screeners strongly disagreed with the statement (see Figure 2).

A Mann-Whitney U test was used to compare the mean rank responses of the school nurses (11.08) to the contractual screeners (9.43). The analysis did not reveal a significant difference between the two groups ( $U = 38.00, p = 0.53$ ).

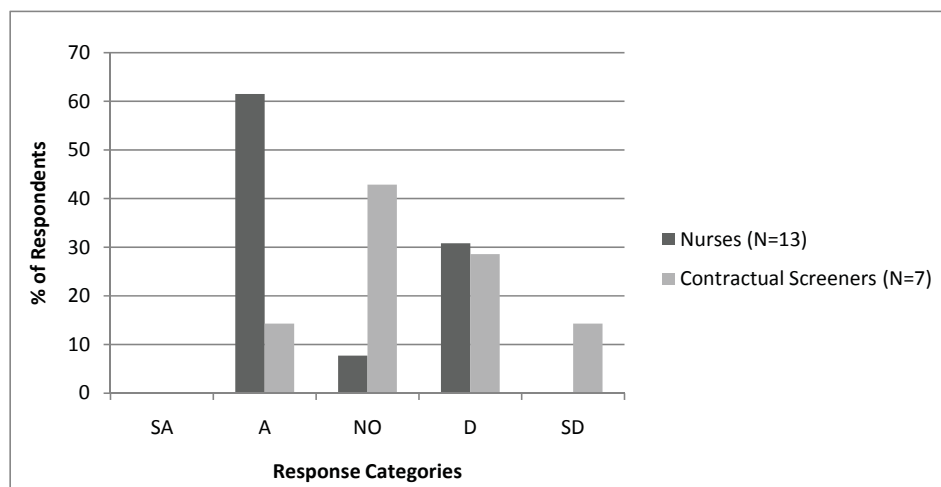
For the statement, *“If students with minimal hearing loss pass the hearing screening, they will have no difficulties learning in the classroom,”* three school nurses (3/13: 23.1%) agreed. One school nurse (1/13: 7.7%) had no opinion, while the majority of school nurses (9/13: 69.2%) disagreed. None of the school nurses strongly agreed or strongly disagreed with the statement.

Two contractual screeners (2/7: 28.6%) agreed with this statement, and one contractual screener (1/7: 14.3%) had no opinion. The majority of contractual screeners (4/7: 57.1%) disagreed with this statement, while none of the contractual screeners strongly agreed or strongly disagreed with this statement (see Figure 3).

Again, a Mann-Whitney U test was used to compare the mean rank responses of the school nurses (10.88) to the contractual screeners (9.79). Results revealed no significant difference between the two groups ( $U = 40.50, p = 0.64$ ).

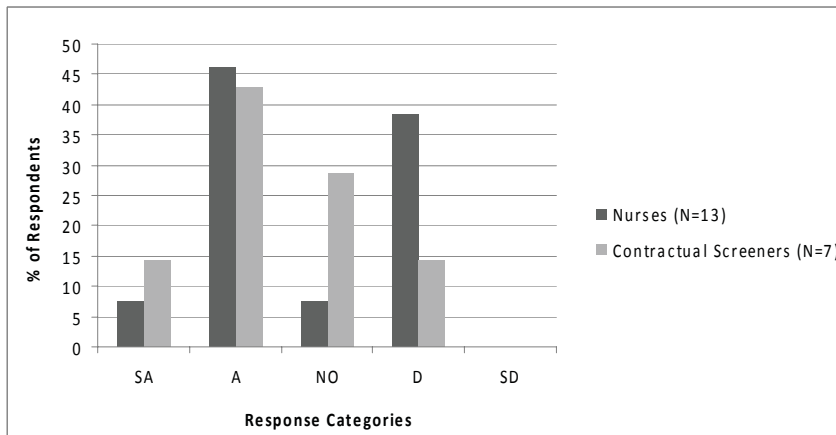
For the fourth and final statement, *“Students are not exposed to noises loud enough to create minimal hearing loss,”* none of the school nurses strongly agreed. One school nurse (1/13: 7.7%) agreed with the statement. Nine school nurses (9/13: 69.2%) disagreed, and three (3/13: 23.1%) strongly disagreed with the statement.

One contractual hearing screener (1/7: 14.3%) agreed with the statement. Three contractual screeners (3/7: 42.9%) had no opinion and three (3/7: 42.9%) disagreed with the statement. None of the contractual screeners strongly agreed or disagreed with the



**Figure 1.** Responses to MHL Statement One: “There is no such entity as minimal hearing loss. In essence, these students have hearing within normal limits.” SA = strongly agree, A = agree, NO = no opinion, D = disagree, and SD = strongly disagree.

**Figure 2.** Responses for MHL Statement Two: “Students with minimal hearing loss will be identified through school hearing screenings.” SA = strongly agree, A = agree, NO = no opinion, D = disagree, and SD = strongly disagree.



statement (see Figure 4).

A Mann-Whitney U test was used to compare the mean rank responses of the school nurses (12.46) to the contractual screeners (6.86). This analysis revealed a significant difference between the two groups ( $U = 20.00, p < 0.05$ ).

**Discussion**

The present study is based on the responses of 35 participants, 18 school nurses and 17 contractual screeners. There were several interesting findings associated with the responses from the hearing screeners, and the following discussion helps to emphasize the importance of training and establishing protocols with the assistance of a primary source, preferably an educational audiologist. The intent of this discussion is not to determine why the two groups provided different responses or whether or not these different responses were appropriate for each group. Each group had separate school administrations that chose to interpret and implement hearing screenings in two distinct manners: one school system used the already available nursing staff and one system hired temporary contractual staff. It is understood that funding issues and staff availability played a role in the decision processes for establishing these two hearing screening programs. However, reasons for the differences were described when a plausible explanation could be used to support the

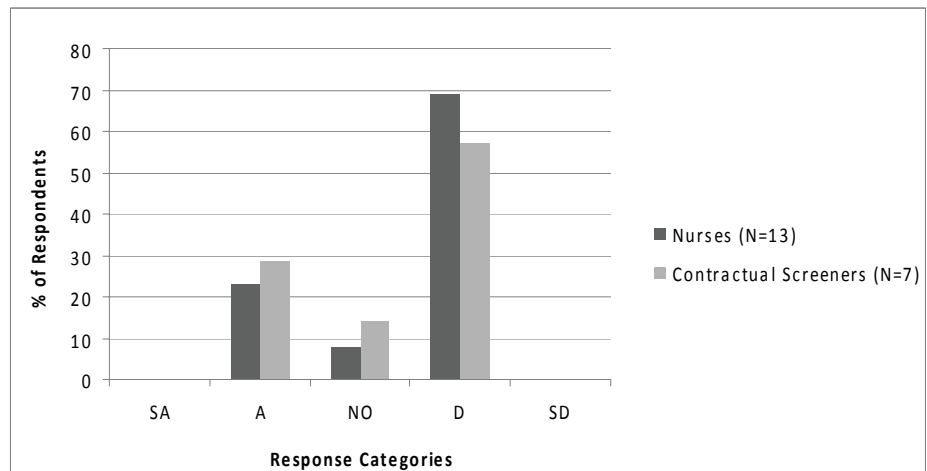
differences.

When addressing the first research question, “Are there significant differences between the hearing screening training of elementary school nurses and the contractual screeners?,” the responses from school nurses showed less uniformity in training sources than the contractual screeners in this study. The majority of school nurses reported having multiple training sources. Although this majority stated that they followed “school policy,” five other sources were identified. It should be noted that school policy itself varies from school to school; therefore, school nurses reporting “school policy” might actually have been trained differently.

All of the contractual screeners reported that they received their training during an in-service provided by an educational audiologist. In all likelihood, the uniform training of this group (by one supervising educational audiologist) contributed to the uniformity in the screening protocols they followed.

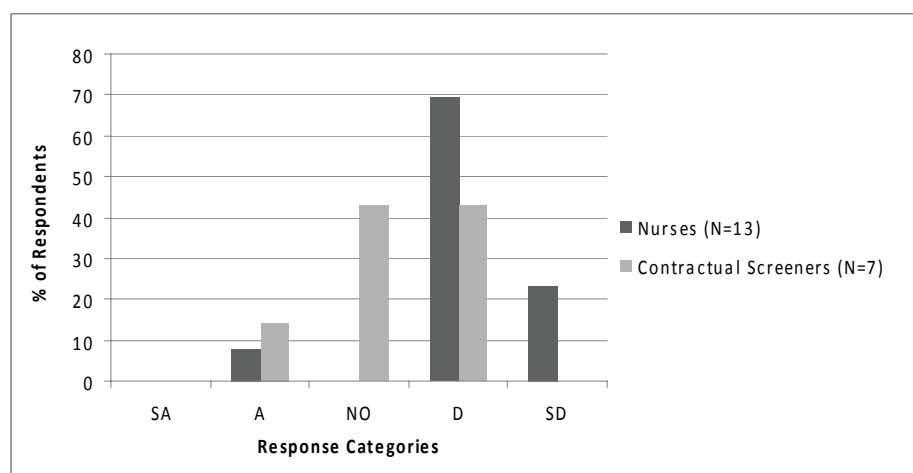
It was interesting to discover that only one of the 35 respondents (an elementary school nurse) indicated that she followed ASHA guidelines for hearing screenings. It could be assumed that the educational audiologist who trained the contractual screeners used ASHA guidelines. However, none of the respondents indicated this on the survey, and some of the procedures used by the contractual screeners did not adhere to the guidelines put forth by ASHA (1997).

**Figure 3.** Responses for MHL Statement Three: “If students with minimal hearing loss pass the hearing screening, they will have no difficulties learning in the classroom.” SA = strongly agree, A = agree, NO = no opinion, D = disagree, and SD = strongly disagree.





**Figure 4.** Responses for MHL Statement Four: “Students are not exposed to noises loud enough to create minimal hearing loss.” SA = strongly agree, A = agree, NO = no opinion, D = disagree, and SD = strongly disagree.



When addressing the second research question, “Are there significant differences in the screening protocols used by the two groups of screeners?” responses from survey items concerning frequencies, intensities, pass/fail criteria, use of otoscopy and tympanometry, and re-screening and referral procedures were examined. Analysis of the frequencies used for hearing screenings showed that the two groups of hearing screeners were statistically significantly different, due to the fact that the contractual screeners tested one additional frequency. That is, the elementary school nurses were uniform in their responses of the frequencies they tested, with all but one nurse screening 500, 1000, 2000, and 4000 Hz. The majority of contractual screeners also screened these frequencies, but they included 6000 Hz. Although the reason for including this frequency cannot be explicitly determined from the survey, this inclusion is consistent with the Missouri DHSS (2004) guidelines for older students. This frequency can also be used to identify students with the early signs of noise-induced hearing loss (Niskar, Kieszak, Holmes, Esteban, Rubin, & Brody, 2001).

Interestingly, none of the published guidelines for school-based hearing screenings indicate that 500 Hz should be screened, but almost all of the respondents from both school systems indicated that they screened this frequency. Due to the ambient environmental noise in a typical school screening location, this particular frequency is often masked, thereby falsely increasing the threshold level at which students respond (Missouri DHSS, 2004; ASHA, 1997). Screening in even a moderately noisy environment

often causes the hearing screener to adjust the pass/fail criteria in an effort to make the screening “fair” for the student (Roush, 1992). The responses of many of the school nurses to the survey item concerning failure criteria seem to reflect this type of adjustment. For example, one elementary school nurse wrote that her criterion was 20 dB for 1000, 2000, and 4000 Hz, but “above 30 dB” for 500 Hz. Missouri DHSS (2004) guidelines state in explicit detail that “it is not appropriate to make adjustments for a noisy environment, i.e., increasing the level of decibels above 25” (p. 14). Any adjustments to the recommended screening protocol can lead to unintentionally

passing students with MHL, either sensorineural or conductive in nature (Roush, 1992; Tharpe & Bess, 1999). Hence, the modification of individual hearing screening procedures contributes to the system-wide discrepancies in hearing screening protocols (Kemper et al., 2004; McDermott & VanTassell, 1981; Roush, 1992; Sophocles & Muzzarelli, 1970).

Another example of these discrepancies could be seen with the school nurses’ varied responses to intensities and failure criteria used. And even though all of the contractual screeners used 25 dB HL as the standard screening intensity (thereby showing more consistency in screening procedures), they all indicated that missing any two frequencies at this intensity level constituted a failure. This is in spite of the fact that ASHA guidelines indicate missing a single frequency requires a referral.

According to Johnson and her colleagues (1997a), “the most critical part of any hearing screening program is the follow-up” (p. 43). ASHA (1997) recommends that re-screenings take place as soon as possible following an initial failure (possibly on the same day). Missouri DHSS (2004) guidelines also recommend performing an immediate re-screening. The Missouri guidelines, however, state that re-screening can “be done up to two weeks later if the student has cold and allergy symptoms” (p. 8). This allows time for any slight middle ear disturbance caused by an upper respiratory infection to clear.

While the majority of respondents in both groups of this study described re-screening and referral procedures that were similar or involved some of the same steps, very few respondents provided the same

response. In fact, none of the elementary school nurses reported following the same protocol. The majority of school nurses reported that they referred students to their PCP. However, additional responses (e.g., “I don’t know,” “a specialist,” and “parent’s choice”) seem to indicate that some school nurses do not have adequate training or knowledge regarding the appropriate follow-up procedures. In contrast, the contractual screeners gave only three different responses: the school nurse, the school system’s audiology office, and the PCP. It is speculated that the single source of training for these contractual screeners allowed a more stream-lined response to the question.

Missouri DHSS (2004) guidelines state that if a student is referred for a comprehensive evaluation, his or her teacher should be notified by the hearing screening professional. The classroom teacher can monitor the student more closely than the hearing screening professional because the teacher is in closer contact with the student everyday. Interestingly, only one respondent to this survey indicated that (s)he notified a student’s teacher regarding a failed screening.

When addressing the third research question concerning differences in the personal opinions of the two groups of screeners regarding students with minimal hearing loss, the last four survey items were analyzed and examined. For the statement, “*There is no such entity as minimal hearing loss. In essence, these students have hearing within normal limits,*” the majority of elementary school nurses agreed with this statement and the majority of contractual screeners had no opinion.

These responses possibly indicate that neither group of hearing screeners ever received accurate, or even any, information on MHL. It is particularly important for hearing screeners to be aware of the existence and characteristics of this type of hearing loss because they are in the unique position of evaluating the hearing of students with MHL on a regular basis (for several years during elementary school). If they are not aware of the characteristics of MHL, as many of the hearing screeners in the present study appear to be, they are less likely to identify this as a hearing loss during hearing screenings.

For the statement, “*Students with minimal hearing loss will be identified through school hearing screenings,*” almost an equal number of school nurses agreed as disagreed, while the majority of contractual screeners agreed. The majority of responses again indicate that there is a lack of information provided to both groups of hearing screeners on this form of hearing loss.

Many of the elementary school nurses surveyed in this study used pass/fail criteria that were much more lenient than those recommended by ASHA and Missouri DHSS guidelines. The contractual screeners also reported using 25 dB HL instead of the 20 dB HL recommended by those guidelines. Modifications to hearing screening protocols such as these might seem to make the test “more fair” to the students, but it is essentially allowing children with unidentified MHL to pass the hearing screening.

For the statement, “*If students with minimal hearing loss pass the hearing screening, they will have no difficulties learning in the classroom,*” the majority of school nurses and contractual screeners disagreed with this statement. This is interesting in light of the fact that the majority of the respondents felt that students with MHL would actually fail (be identified through) the hearing screening. Yet, these responses indicate that many of the hearing screeners are aware that simply passing the hearing screening does not preclude further learning and listening difficulties in the classroom.

For the final statement, “*Students are not exposed to noises loud enough to create minimal hearing loss,*” statistical analyses found the only significant difference for all four statements concerning MHL. The majority of school nurses disagreed or strongly disagreed with this statement, while most of the contractual screeners either had no opinion or disagreed. It is not surprising that the school nurses responded more accurately. The National Association of School Nurses (2003) published a position statement on the issue of noise-induced hearing loss, which states that, “addressing noise induced hearing loss should be an integral part of the school nurse’s responsibility” (p. 2). Therefore, it is likely that the school nurses incorporate hearing conservation as part of their job in promoting the overall health of their students. It is possible that because the contractual screeners do not have the same major role in the general health of the students, they do not know as much about hearing conservation. This is a topic in need of further study.

School-age children with minimal hearing loss often passed their newborn hearing screenings (Yoshinaga-Itano, 2006). According to Yoshinaga-Itano, it is more efficient, in terms of cost and time (due to a possible increased false positive rate), for the newborn screening equipment to pass infants with hearing better than a mild to moderate hearing loss. For this reason, it is imperative that school-based hearing screenings identify students with MHL. Strict adherence to proposed guidelines, with minimal adjustments to the screening protocol,

will help to ensure that students with MHL will be identified during the hearing screening. More importantly, however, the people who conduct school-based hearing screenings need to have an accurate understanding of MHL.

This relatively small sample size may have affected some of the results of the study and due to the small number of participants, the use of statistical analyses was limited. A larger sample size might have resulted in more statistically significant differences between the two groups. Therefore, the results of this study cannot be generalized to the school-based hearing screening protocols and hearing screeners in other school systems.

### **Conclusions**

Guidelines have been developed by national and state agencies in order to encourage greater uniformity in screening protocols. However, based on the responses of the participants in this study, these guidelines are not being followed. Even the group directly supervised by an educational audiologist incorporated some procedures that are specifically discouraged in the state and national guidelines (e.g., including 500 Hz and using 25 dB, instead of 20 dB, as the failure criteria).

Despite the lack of overall uniformity in the hearing screening protocols of the elementary school nurses and despite the direct supervision of the contractual screeners by an educational audiologist, the two groups responded similarly on the majority of the MHL survey items. It is possible that the more accurate responses from the school nurses concerning noise-induced hearing loss were due to their role as the primary healthcare professional in each elementary school. It is also possible that because the contractual screeners are directly supervised by an educational audiologist, they defer many of their questions to the expertise of the supervising audiologist. Whatever the reason, it is evident that all of these hearing screeners could benefit from more information regarding MHL.

The findings in this study lend further support to previous research on the uniformity and effectiveness of school-based hearing screenings. Very little seems to have changed in 40 years. The work and efforts that the National Conference on Identification Audiometry and ASHA have put forth throughout the years are still not being uniformly embraced and used. Earlier studies found that different schools, even those within the same school system, followed different hearing screening protocols (Kemper et al., 2004; McDermott & Van Tassell, 1981; Roush, 1992; Sophocles & Muzzarelli, 1970). The present study supported these findings. This study also showed that in a school system with no common source of training or supervision, there was great variation in the protocols used by the individuals who conduct

the hearing screenings. In a school system in which all of the hearing screeners had a single supervisor (an educational audiologist and the primary person in charge of training), the protocol was much more uniform.

It can be concluded that supervision by an educational audiologist can lead to more uniform screening protocols. A uniform screening protocol for an entire school system should result in more accurate screening results, a better system for referrals, and proper diagnoses. Therefore, the presence of educational audiologists in the school setting (especially during the screening process) would be beneficial for students with previously undiagnosed hearing loss, including MHL.

### **Future Studies**

Several areas of further research were identified throughout the course of this study. A follow-up survey of the contractual hearing screeners who chose not to respond to questions on MHL may provide more insight into the reasons why these participants felt they were unqualified to offer their opinions on this topic. It would also be valuable to gather more information on the hearing screeners' understanding of and experience with students who have hearing loss, especially MHL. Additionally, further research should examine the opinions of clinical and educational audiologists on issues related to MHL.

This study revealed that some hearing screeners, even when supervised by an audiologist, do not adhere to published screening guidelines. Again, it would be advantageous to determine if audiologists themselves follow the protocols put forth by ASHA and other state organizations, or if they also make modifications based on the screening situation. Lastly, due to the lack of exposure of some elementary school nurses to audiologists, it might also be beneficial to survey audiologists on the interactions they have had with nurses who conduct school hearing screenings.

### **Acknowledgements**

The authors would like to thank Lyn Goldberg and Neil DiSarno for their helpful comments and suggestions during the thesis writing phases of this research. They would also like to thank Stephanie Davenport for her help with statistical analyses and Michelle Augustine for her help with the survey procedures. Finally, the authors would like to thank the school nurses and contractual hearing screeners who took the time to complete this survey and provide their opinions.



## References

- American Speech-Language-Hearing Association Audiologic Assessment Panel 1996 (1997). *Guidelines for audiologic screening*. Rockville, MD.
- Bess, F.H., Dodd-Murphy, J., & Parker, R.A. (1998). Children with minimal sensorineural hearing loss: Prevalence, educational performance, and functional status. *Ear and Hearing, 19(5)*, 339-354.
- Colorado Department of Education (2001). *Colorado early childhood hearing screening guidelines (2nd ed.)*. Denver, CO.
- Darley, F.L. (1961). Identification audiometry. *Journal of Speech and Hearing Disorders, Supplement 9*, 62-68.
- Flanary, V.A., Flanary, C.J., Colombo, J., & Kloss, D. (1999). Mass hearing screening in kindergarten students. *International Journal of Pediatric Otorhinolaryngology, 50*, 93-98.
- Indiana Speech-Language-Hearing Association. *ISHA's Revised guidelines for school hearing conservation program*. (n.d.). Retrieved November 28, 2007 from [www.islha.org/revised\\_guidelines/](http://www.islha.org/revised_guidelines/).
- Jaccard, J., & Wan, C. K. (1996). *LISREL approaches to interaction effects in multiple regression*. Thousand Oaks, CA: Sage Publications, Inc.
- Johnson, C. D., Benson, P. V., & Seaton, J. B. (1997a). *Educational audiology handbook*. United States: Singular – Thomson Learning.
- Johnson, C. E., Stein, R. L., Broadway, A., & Markwalter, T. S. (1997b). "Minimal" high-frequency hearing loss and school-age children: Speech recognition in the classroom. *Language, Speech, and Hearing Services in Schools, 28*, 77-85.
- Kaderavek, J. N., & Pakulski, L. A. (2002). Minimal hearing loss is not minimal. *TEACHING Exceptional Children, 34(6)*, 14-18.
- Kemper, A.R., Fant, K.E., Bruckman, D., & Clark, S.J. (2004). Hearing and vision screening program for school age children. *American Journal of Preventative Medicine, 26(2)*, 141-146.
- Louisiana Department of Education (2007). Health screening. *Louisiana Department of Education Bulletin 741: Title 28, Part CXV*, 24-25.
- Mannina, J. (1997). Finding an effective hearing testing protocol to identify hearing loss and middle ear disease in school-aged children. *Journal of School Nursing, 13(5)*, 23-28.
- McCormick Richburg, C. & Goldberg, L. R. (2005). Teachers' misperceptions about minimal hearing loss: A role for educational audiologists. *Communication Disorders Quarterly, 27(1)*, 4-16.
- McDermott, L. D., & VanTassell, D. J. (1981). A preliminary report on the need for statewide standards for hearing screening. *Language, Speech, and Hearing Services in Schools, 12*, 44-48.
- Missouri Department of Health and Senior Services (2004). *Guidelines for hearing screening*. Jefferson City, MO.
- Morgan, G. A., Leech, N. L., Gloeckner, G. W., & Barrett, K. C. (2004). *SPSS for introductory statistics*. Mahwah, NJ: Lawrence Erlbaum Associates.
- National Association of School Nurses. (2003). *Position statement: Noise induced hearing loss*. Retrieved on November 28, 2007 from [www.nasn.org/Default.aspx?tabid=232](http://www.nasn.org/Default.aspx?tabid=232).
- Niskar, A. S., Kieszak, S. M., Holmes, A. E., Esteban, E., Rubin, C., & Brody, D. J. (2001). Estimated prevalence of noise-induced hearing threshold shifts among children 6 to 19 years of age: The Third National Health and Nutrition Examination Survey, 1988-1994, United States. *Pediatrics, 108(1)*, 40-43.
- Norusis, M.J. (1990). *SPSS introductory statistics student guide*. Chicago, IL: SPSS.
- Pennsylvania Department of Health (2001). *Guidelines for the school hearing screening program for Pennsylvania's school age population*. Retrieved on November 28, 2007 from [www.dsf.health.state.pa.us/health/lib/health/schoolhealth/HearingGuideline.pdf](http://www.dsf.health.state.pa.us/health/lib/health/schoolhealth/HearingGuideline.pdf)
- Roush, J. (1992). Screening school-age children. In F. Bess & J. C. Hall (eds.), *Screening children for auditory function* (pp.297-314). Nashville, TN: Bill Wilkerson Center Press.
- Roush, J., Bess, F., Flexer, C., Gravel, J., Margolis, R., Northern, J., Nozza, R., & Silman, S. (1997). Identification of hearing loss and middle ear dysfunction in preschool and school age children (American Academy of Audiology, Report and Position Statement). *Audiology Today, 9(3)*, 18-23.
- Salkind, N. J. (2004). *Statistics for people who (think they) hate statistics*. Thousand Oaks, CA: Sage Publications, Inc.
- Sophocles, A. M., & Muzzarelli, R. A. (1970). Hearing screening programs in Mercer County's public schools. *The Journal of the Medical Society of New Jersey, 67(2)*, 70-73.
- Tharpe, A. M., & Bess, F. H. (1991). Identification and management of children with minimal hearing loss. *International Journal of Pediatric Otorhinolaryngology, 21*, 41-50.



- Tharpe, A. M., & Bess, F. H. (1999). Minimal, progressive, and fluctuating hearing losses in children: Characteristics, identification, and management. *Pediatric Clinics of North America*, *46*(1), 65-78.
- West, S. R. & Harris, B. J. (1983). Audiometry and tympanometry in children throughout one school year. *The New Zealand Medical Journal*, *96*(737), 603-605.
- Yoshinaga-Itano, C. (February 2006). *What have we learned about children with hearing loss from universal newborn hearing screening?: From research to practice*. Paper presented at the Missouri State University Pathways to Communication Conference, Springfield, MO.

## Appendix A

### Survey for Hearing Screeners

#### DEMOGRAPHIC INFORMATION:

Job Title \_\_\_\_\_

Job responsibilities \_\_\_\_\_

At how many schools do you perform hearing screenings? \_\_\_\_\_

How long have you held this position? \_\_\_\_\_

Please answer the following questions about hearing screenings. Feel free to make comments in the margins or at the end of the survey.

1. If applicable, who helps perform the hearing screenings for grades K through 3rd ? (Circle all that apply)

Nurses  
Teachers  
Speech-Language Pathologists  
Special Education Teachers  
Other \_\_\_\_\_

Parents/Volunteers  
Teacher's aide  
Audiologists from surrounding areas  
University Students

2. Where are the hearing screenings conducted? (Circle all that apply)

Library  
Hallways  
Auditorium/Gym  
Band Hall/Choir Room  
Other \_\_\_\_\_

Classrooms  
Closet  
Trailer brought in by contractor of services

Office Area  
Cafeteria

3. How would you describe the noise levels where the hearing screenings are provided? (Circle one)

1 2 3 4 5 6 7 8 9 10  
very soft                      average                      very loud

4. How often are the hearing screenings typically conducted? (Circle one)

Once during a school-year  
Three times during a school-year  
Other \_\_\_\_\_

Twice during a school-year  
Only when needed

5. What students are screened? (Circle all that apply)

Kindergarten  
3rd grade  
Special Education  
Other \_\_\_\_\_

1st grade  
4th grade  
New Students

2nd grade  
5th grade

6. When are the hearing screenings conducted? (Circle one)

Fall                      Spring                      Other \_\_\_\_\_

7. During the hearing screening procedure...

- a. what frequencies are tested?
- b. what intensity levels are tested?
- c. what criteria are used for failing?
- d. how many children are tested at one time (in the same room if there are multiple screeners)?
- e. is middle ear screening (tympanometry) used? YES NO
- f. is otoscopy (looking into the ear canal) used? YES NO

8. Where did you get the information regarding the procedure that you follow during a hearing screening?  
(Circle all that apply)

State Guidelines American Speech-Language-Hearing Association Guidelines  
 School Policy I was shown this procedure by the previous hearing screener  
 I don't know In-service training Other \_\_\_\_\_

9. Approximately how many children are screened every year per elementary school? \_\_\_\_\_

10. During the most recent hearing screening, how many children failed the screening?  
(Fill in for all schools, if you screen at more than one.)

- |                     |                      |
|---------------------|----------------------|
| # _____ at school 1 | # _____ at school 7  |
| # _____ at school 2 | # _____ at school 8  |
| # _____ at school 3 | # _____ at school 9  |
| # _____ at school 4 | # _____ at school 10 |
| # _____ at school 5 |                      |
| # _____ at school 6 |                      |

Add more if necessary \_\_\_\_\_

11. Please describe the procedure you follow when a child fails a hearing screening. Please include information about re-testing days, follow-up times, and referrals.

12. If a child is referred for failing a screening, to whom is that child referred?

13. When a child is absent on the screening day, what actions are taken, if any.

**PLEASE READ THIS STATEMENT:**

When children are tested for hearing impairment, they are presented with tones at soft levels (0 – 25 dB HL) across a range of pitches (low to high). Children who can hear at these levels are considered to have normal thresholds of hearing. However, some people believe that having hearing thresholds in the 16-25 dB HL range can affect children’s speech development and learning capabilities. Therefore, this range has been named the range of “minimal hearing impairment.”

WITH THIS INFORMATION, PLEASE USE THE FOLLOWING FIVE-POINT SCALE TO RESPOND TO THE STATEMENTS BELOW. CIRCLE YOUR ANSWER. ONE ANSWER ONLY, PLEASE.

(1) strongly agree (2) agree (3) neutral (4) disagree (5) strongly disagree

14. There is no such entity as minimal hearing impairment. In essence, these students have hearing within normal limits.

(1) strongly agree (2) agree (3) no opinion (4) disagree (5) strongly disagree

15. Students with minimal hearing impairment will be identified through school hearing screenings.

(1) strongly agree (2) agree (3) no opinion (4) disagree (5) strongly disagree

16. If students with minimal hearing impairment pass the hearing screening, they will have no difficulties learning in the classroom.

(1) strongly agree (2) agree (3) no opinion (4) disagree (5) strongly disagree

17. Students are not exposed to noises loud enough to create minimal hearing impairment.

(1) strongly agree (2) agree (3) no opinion (4) disagree (5) strongly disagree

Additional comments. \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

*Thank you for completing this survey.*