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Comparison of Training Models for Hearing Screening Personnel

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Capstone Document

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By

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ABSTRACT

Early identification of permanent hearing loss begins with the competency of the individuals completing a hearing screening in being able to identify children who are at-risk for hearing loss. The appropriate management of hearing healthcare for children, during the developmental period from birth to school age, requires these individuals to possess knowledge related to screenings, protocols, and follow-up, for children in need of additional diagnostic services. The Early Childhood Hearing Outreach (ECHO) Initiative was formulated by the National Center for Hearing Assessment and Management (NCHAM) as an extension to newborn hearing screening programs. The program focuses on assisting hearing screeners and healthcare providers who serve children birth to three years of age. In 2014, the Illinois State University ECHO Team began contracted services for the Illinois ECHO program. Its focus was to establish and provide an effective training model for otoacoustic emission hearing screenings using course curriculum supported by the ECHO Initiative.

The current study assessed the validity of the ECHO Initiative curriculum. It further sought to compare didactic-based and practicum-based training models to determine if any significant differences in degree of knowledge acquisition or retention could be observed. While the curricular content of the ECHO program demonstrated a significant effect on knowledge acquisition, minimal differences between training models were identified. The data collected between training models helped to highlight functional implications for effective grant sponsorship. Relocation of service in conjunction with alternative delivery methods, as well as a review of Illinois mandated reporting forms, were discussed as a much-needed consideration for the future of the ECHO program within the state of Illinois.

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CHAPTER 1

Introduction

Impact of Hearing Loss and Importance of Early Intervention

Hearing loss can have a significant impact on many facets of a child's development, including cognitive, social, and linguistic implications (Choing et al. 2007; Moore, 1996). It is believed that some degree of permanent hearing loss is seen in about one out of every 300 children born in the United States (White, 1996). Further, it has been estimated that bilateral, profound, hearing loss can occur as frequently as one in 724 births (Choing et al., 2007). With hearing loss occurring in a high percentage of overall births, early identification, diagnosis, and intervention is vital.

Children growing up with undiagnosed hearing loss may have limited access to important auditory cues that are needed to help promote appropriate cognitive, social, and linguistic development. Choing et al. (2007) found a significant correlation between overall cognitive development and the presence of hearing loss. Results revealed that bilateral, profound, hearing loss was correlated with lower mental development, on average, for overall IQ, as well as scales involving: locomotor, personal-social, hearing and speech, and hand-eye coordination performance. When compared to similar aged peers, children with mild unilateral or bilateral hearing loss were found to have lower than average cognitive development in 40 percent of the affected population. The authors inferred that this occurred as a result of language delays related to decreased access to auditory information and a lack of early intervention services.

The presence of hearing loss has been reported to have a significant impact on a child's development of social knowledge for interacting with others, and this stems from a lack of intake of psychoacoustic information. For a child with hearing loss, there is restricted access to auditory

information as it pertains to frequency resolution, frequency discrimination, and time resolution, which makes social interaction with others significantly harder (Moore, 1996). Because significant correlations for adverse developmental effects on cognition and language exist in some capacity across all degrees of hearing loss, the importance of early identification services cannot be overstated. As it relates to these child developmental factors, state healthcare agencies are tasked with establishing and maintaining effective screening programs.

Early Intervention Management

State Early Hearing Detection & Intervention (EHDI) agencies are a mainstay in helping their respective state program deliver screening, diagnosis, and provision of intervention services for hearing loss in infants and young children. In the state of Illinois, the EHDI program is implemented through the collaboration of three state institutions. These institutions include the University of Illinois at Chicago- Division of Specialized Care for Children (UIC-DSCC), Illinois Department of Public Health (IDPH), and Illinois Department of Human Services – Bureau of Early Intervention (IDHS-EI). UIC-DSCC is tasked with coordinating, and funding, specialized medical care for children with eligible medical conditions. IDPH is responsible for collection and monitoring of information of children identified with, or at-risk for, hearing loss as a result of a positive hearing screening result. IDPH maintains cases of confirmed screenings for use in appropriate implementation of follow-up. IDHS-EI assures that families with children who have an identified disability or impairment receive the necessary assistance to promote their child's development. The primary function of all national EHDI programs is to utilize the 1-3-6 intervention plan (Illinois EHDI Program, 2015). Under the this plan, all newborn infants should be screened for hearing loss by one month of age, identified and diagnosed with hearing loss by

three months of age, and enrolled in early intervention programs by six months of age. This intervention approach has been associated with favorable developmental outcomes for hearing-impaired children.

Lost to Follow-Up in Early Intervention

While the state of Illinois has maintained a consistent screening rate within one month of age for at least 98 percent of all infants born in the state, the follow through and completion of the remaining steps of the 1-3-6 model have been lackluster. Lost to follow-up (LOTF) is a relevant and glaring concern for screening programs in the state of Illinois. According to the American Speech-Language Association (ASHA, 2008), an infant is considered LOTF when they do not receive the recommended procedures for diagnostic, screening, or intervention services. There can be several reasons why a child is considered LOTF. The Centers for Disease Control (CDC, 2008) recognizes an infant as a "no documented diagnosis" case if they (1) have not fulfilled recommendations, (2) are still in process of fulfilling recommendations, (3) declined services via the parents or caregivers, (4) died, (5) are not residents of the state, (6) moved out of jurisdiction, (7) cannot be reached, or (8) are unresponsive. While some of these reasons for LOTF fall outside of the role of a screener's responsibility, many institutional influences may still be addressed.

Several conditions produce barriers between institutions and agencies seeking provision of follow-up services for infants and young children identified by screenings. One of the main issues observed within the institutional realm involves a breakdown in communication between healthcare providers, families, and screening programs (Hoff et al., 2006). Inadequate data management and tracking procedures have also been identified as a contributing factor in restricted healthcare access across states (JCIH, 2007). According to the Illinois State EHDI Health

Resources and Services Administration (HRSA) report (Illinois EHDI Program, 2015), staffing shortages, and a lack of training for screening personnel, created significant barriers in the delivery of services to the public. Increased rates of staffing turnover have negatively affected the ability of agencies to sustain an adequate screening program. The observed lack of training for screening personnel has resulted in substantially high referral rates, with some facilities reporting referral rates well above 10%. Depending on the type of screening method utilized, referral rates should range between 3.21%-6.49%, and should not typically exceed the latter (Vohr et al., 2001). Rates exceeding 10% are counterproductive and bog down the referral network, occupying the appropriated slots of qualified pediatric audiologists with the evaluation of normal-hearing patients.

Lost to follow-up can affect the developmental period for children from birth to school age. Children who are unable to complete the hearing screening and identification process for hearing loss run the risk of delaying beneficial intervention that is crucial for appropriate language, social, and emotional development. Even children that receive universal newborn hearing or early childhood screenings are occasionally lost in the process-referral cycle. Insufficient reporting can derail progress towards diagnostic assessment and necessary intervention. Discontinuity within the referral network decreases the effectiveness of what is designed to be an efficient process. Fortunately, an early-intervention screening protocol has been established to be easily implemented within the developmental period. The goal of the screening protocol is to make the identification of hearing loss more efficient and effective.

Early Childhood Hearing Outreach Initiative

The Early Childhood Hearing Outreach (ECHO) Initiative was established in 2001 by the National Center for Hearing Assessment and Management (NCHAM), through Utah State University. It sought to address screening issues related to infants and young children who were considered loss to follow-up, provided a false-negative newborn hearing screening result, or were considered at-risk for late onset of hearing loss (ECHO, 2014). This initiative serves as an extension to newborn hearing screening programs and focuses on the birth to three years of age population. The ECHO Initiative currently has active programs underway in over 20 states. These screening initiatives are oversighted, or supported by, pediatric audiologists and state EHDI coordinators (Eiserman & Shishler, 2010). Otoacoustic emission (OAE) screening protocols have been utilized in an effort to identify the target population by the ECHO Initiative.

The use of OAE technology has shown to be a valuable asset for rapidly screening young children and identifying those at risk for hearing loss. Implementing distortion product otoacoustic emissions (DPOAE) as a screening method has been found to be equally as sensitive to sensorineural and conductive hearing losses when compared to standard pure-tone audiometry. Otoacoustic emission screening protocols have proven to be time-efficient, highly reproducible, and objective (Kresiman et al., 2008). These positive factors support the use of OAE screening protocols as a feasible and accurate practice for identifying hearing-health conditions in the birth-to-three-years population (Eiserman et al., 2008). With empirical evidence of the efficacy and validity of OAE screening protocols, as well as a demonstrated benefit from the national program of the ECHO Initiative, a state level ECHO program was introduced in Illinois. This program was enacted to address pressing issues related to the hearing screening process.

The ECHO Initiative in the State of Illinois was established in 2011 through the support of the Illinois EHDI program and its subcomponent organizations. The IDPH provided training and

services in support of the ECHO Initiative from 2011-2014. The primary objective for the ECHO program in the State of Illinois is to reduce LOTF among infants who failed their newborn hearing screening prior to hospital discharge, or failed to return for an outpatient OAE rescreen. According to the Human Resources and Services Administration report (Illinois EHDI, 2015), from January to September of 2015, 1,322 infants did not pass their newborn hearing screening. Of the 1,322 infants, 208 demonstrated normal results after being rescreened, 123 were diagnosed with hearing loss, 940 remained "in-process" for follow up, and 51 were undesignated. The 940 that were still "in-process" were counted as LOTF. This sample equates to a LOTF rate of 71.1% for the State, which is more than double that of the last reported national average at 32.1% in 2013 (CDC, 2016). Even though Illinois reports a larger than average rate, the implementation of the ECHO program has demonstrated a gradual reduction in the LOTF rate since its creation. Prior to 2015, LOTF rates were at 80.4% in 2013 and 73.1% in 2014. As evidenced by these numbers, nearly a 10-point improvement in LOTF has been observed since the implementation of the ECHO program began.

In the fall of 2014, the Communication Sciences and Disorders department at Illinois State University was contracted to administer the ECHO program for the State of Illinois. This included the provision of OAE trainings for targeted health personnel, capturing individuals working in home-visiting programs, such as Early-Head Start (EHS) and Parents as Teachers (PAT), and staff from local County Health Departments. The Illinois State University ECHO Team sought to provide appropriate trainings for healthcare personnel with differing levels of experience in OAE screening. Components for the trainings included: (1) highlighting the importance of the early identification of hearing loss in children, (2) providing a thorough introduction to OAEs and OAE screening protocols, (3) providing hands-on experience with OAE hearing screening equipment, (4) providing troubleshooting techniques, and (5) highlighting steps for accurate documentation

and reporting to the IDPH of all children screened. To achieve each of these objectives, it was necessary to explore effective training models that would sufficiently convey all aspects of the screening and reporting process within a comprehensive state screening program.

Learning structure and type of training model each have a significant influence on the delivery of learning materials to individuals enrolled in a training course. According to Clark (2008), four key components make up all learning environments. These components include the (1) delivery mode of information, (2) method or technique used to facilitate learning, (3) provider of the information, and (4) underlying architecture of how a lesson is structured. A learning environment should focus its structure on becoming an active training. An active training helps to strengthen the learning process, promote deeper knowledge retention, encourage application of material, and provide a better all-around learning experience (Silberman & Auerbach, 1990).

When applied to medical trainings, the active training ideology has shown beneficial outcomes. This style of learning has been positively described in many facets of medical literature. Kaddoura (2011) reported that traditionally structured, lecture-based, group programs, positively benefited novice medical nursing students in clarifying complicated or unfamiliar concepts related to their professional scope. When this method was combined with a hands-on learning structure, further improvements in knowledge retention were commonly observed (Brannan, White, & Bezanson, 2008; Agel, & Ahmad, 2014). While research findings have been in support of these training structures, it is important to consider the unique challenges for appropriately implementing trainings for novice hearing screeners.

There are two major concerns that are pertinent to structuring an appropriate and effective training model. As highlighted in Clark (2008), the experience level of the individual receiving the training, and the functional impact that the training has on that individual, can influence the success

of the program. Prior knowledge of a topic is one of the most significant influences that can affect learning. Experience level must be considered when structuring training content because, the more inexperienced an individual is, the less mental resources are available to be drawn upon to integrate new knowledge. As such, learning content should be identified as involving routine and non-routine tasks. Training involving routine tasks focuses on the near-transfer of information, which means that information taught will be directly applied on a frequent basis. Training involving non-routine tasks involves the far-transfer of information. This means that information taught will not occur frequently and may require the need for extensive judgment of outcomes, particularly for individuals without prior knowledge.

A variety of training models have been utilized during the time that the Illinois State University ECHO Team has administered OAE trainings. The first cycle year (CY) of contracted services began in August of 2014 and concluded in March of 2015. It featured a didactic training structure, focused on a lecture-based learning theorem. Following a change of the Principal Investigator (PI) of the contract, the second CY of services, from August 2015 through March 2016, introduced a revised training structure. This new curriculum style involved a practicum training structure, focused on the facilitation of learning through a hands-on based learning theorem. A comparison of these training models was routinely analyzed via pre-training and post-training assessment, as well as long-term knowledge retention assessment, in order to determine if any significant differences in program effectiveness might be observed.

The current study was conducted to assess the validity of the revised ECHO Initiative training curriculum, which applied an NCHAM approach to determine if a difference in the degree of knowledge acquisition could be observed between training models. These aims were analyzed using a pre-training and post-training assessment that was focused on competencies stated within

the ECHO material. Further, we sought to determine if a difference in knowledge retention could be observed between training models. It was hypothesized that findings from the current study would identify the ECHO Initiative curriculum to be a valid training for OAE screenings. It was hypothesized that greater knowledge acquisition would be observed during the latter model when compared to the former model. Finally, implementing a practicum based training model was predicted to be able to generate greater knowledge retention over time when compared to a didactic based training model.

CHAPTER 2

Methodology

Subjects

A total of 78 nursing and health-support personnel from Illinois County Health Departments, Early Head-Start (EHS) Association, and Parents as Teachers (PAT) organization were included in the sample. Participants from 29 counties in the state of Illinois were provided a full-certification Early Childhood Hearing Outreach otoacoustic emission training from August 2014 through March 2016, by the Illinois State University ECHO Team. The data collection time-period spanned two grant cycles, Cycle Year- Didactic (coded: CY-DD) and Cycle Year-Practicum (coded: CY-PR). During CY-DD, from August 2014 through March 2015, 56 participants were provided a didactic based training model. In CY-PR, from August 2015 through March 2016, 22 participants were provided a practicum based training model.

Pre-training and post-training assessment data were collected from 56 personnel within the CY-DD condition, and 19 of 22 individuals within the CY-PR condition. Three participants did not complete assessments, as they declined to participate. In the months following the OAE training, 25 participants from CY-DD and 9 participants from CY-PR completed a retention questionnaire re-assessing screening knowledge competencies. Participants who did not complete the retention questionnaire either declined to participate, were terminated from or left their current screening position, or were deemed non-respondents.

Instrumentation

While different training models were utilized between conditions, the core competencies of the ECHO OAE trainings were derived from a National course curriculum sanctioned by the

ECHO Initiative and its founding organization, the National Center for Hearing Assessment and Management. Fundamental principles of the NCHAM ECHO Initiative included: (1) a comprehensive introduction to OAE screenings and reporting of results, (2) appropriate use of documentation, (3) necessary components of a successful OAE screening program, and (4) management of screening personnel and patients. The curriculum for both training models was formulated based on these widely-accepted principles.

Training Format

In the CY-DD condition, course materials were structured around a lecture based curriculum. Topics that were highlighted for this model included: (1) importance of identifying hearing loss, (2) laws pertaining to screening programs in the State of Illinois, (3) role of ECHO, (4) introductions to OAEs, (5) anatomy and physiology of the ear, (6) preparation for screening, (7) overview of screening protocols, (8) screening practice, (9) data reporting, and (10) troubleshooting screenings. These topics were delivered primarily through a Microsoft PowerPoint presentation and guided the course of education. Training practices and group discussions were incorporated as a secondary learning tool to the primary lecture of the slides. Participants also received a copy of the PowerPoint slides that were discussed during the training, as a reference to be used in a real-world setting.

The CY-PR condition utilized comparable curricular content as the CY-DD condition, and focused on facilitating knowledge acquisition through use of practical exercises. Therefore, training modules (M) were created for the Illinois ECHO program to address the learning needs of the participants (Table 1). By creating training modules, the reliance on PowerPoint slides was substantially diminished. These structural enhancements were intended to place an emphasis on a

“see one, do one” approach to learning. Through this training model, participants were provided with a course packet as a secondary learning instrument within the practicum.

Each participant was provided a course packet to be used during the CY-PR training. Reference learning materials within the course packets included: ECHO course agenda, OAE Screening Skills Checklist, Planning Checklist for Implementing an OAE Screening Program, OAE Screening Form, OAE Diagnostic Follow-up Form, and OAE Screening & Diagnostic Log (refer to kidshearing.org). Screening exercises were created for the CY-PR condition. Training Exercises (E) 1-5 were incorporated within various training modules to enhance the learning of subject materials. The exercises included:

- E1 within M0, providing an introduction to hearing loss by engaging participants in a simulation of hearing loss
- E2 within M6, the class had to guide the course facilitator and volunteer through a demonstration of an actual screening using the OAE Screening Skills Checklist
- E3 within M7, the course facilitator guided the class through requisite screening practices using the OAE Screening Skills Checklist
- E4 within M8, partner screening practice with the influence of external and internal noise
- E5 within M9, group screening practice with patient management scenarios

Documentation exercises were also incorporated within M9. Three different screening scenarios were presented to the class. The class was tasked with documenting each case appropriately using the OAE Screening Form, OAE Diagnostic Follow-up Form, and OAE

Screening & Diagnostic Log. With the accompanying assistance of the course facilitator, participants were provided scenarios for which each document would be utilized.

The ECHO video modules were embedded within the course modules. These educational videos were obtained free of charge from the National ECHO website. These videos guided participants through NCHAM recommended screening methods, and were referenced at the beginning of each course module throughout the training.

Assessment Format

Participants were assessed using a pre-training and post-training multiple-choice assessment (Appendix A), as well as a retention assessment (Appendix B). The 15 questions that were presented in the pre-training and post-training assessments were subdivided into the following subscales:

- Knowledge of OAEs
- Management of protocols and patients
- Management of documentation

An overall comprehensive score was produced by the assessment. To optimize the response rate, an abbreviated retention assessment was formulated using eight of the 15 pre-training and post-training assessment questions.

The pre-training and post-training assessment questions within the current study were formally implemented by the Illinois Department of Public Health, from 2011-2014. An analytical comparison using historical data was originally considered for inclusion in the dataset; however, individual assessment data and the use of subscales was not incorporated into statistical reporting

for the 2011-2014 time period. Group-level statistical data were reported in the historical subset; whereas, individual statistical data were established for the data subset in this study. Individual data were incorporated as a feasible method of assessing change regarding knowledge acquisition relative to sample size for the CY-DD and CY-PR subsets. Appropriate cross-analysis could not be established between historical and current subsets, and it was determined that statistical analysis could not be conducted reliably.

Subject identification information was not retained for assessment data in CY-DD and CY-PR. Analysis of pre-training and post-training scores was completed via a 3-digit pre-post identification number. This number was assigned to each participant following the collection of course assessment packets. For participants who completed a pre-training and post-training assessment, a retention assessment was provided in the months following training. The retention assessment was introduced via an online survey link. Eight of the original 15 assessment questions were incorporated within this retention assessment. The same subscales were utilized for the retention assessment as for the pre-training and post-training assessment. The classification of subscale questions included:

- Three (3) OAE items
- Two (2) items about management of protocol and patients
- Three (3) management of documentation items

An overall comprehensive score was produced by the assessment.

A retention identification number was provided to participants in the introductory message to account for the anonymous responses generated using an online service. This identification was separate from the pre-post identification provided after the pre-training and post-training

assessment phase. The retention identification denoted the retention group into which the individual was assigned. The pre-post identification was used to ascertain knowledge that followed the completion of the ECHO training. Groups were separated between retention group A (CY-DD) and retention group B (CY-PR). A numerical label was assigned to each group to ensure duplicate responders were not included in the retention subset (i.e., A1, A2, A3, etc.). Analysis was conducted using a group subset to measure if a difference in knowledge retention between various conditions existed. Due to the small count of retention conditions, and the absence of identifying information with pre-post identification, individual assessments could not be analyzed.

Procedures

The program was formulated through HRSA grant funding in 2014. Its goal was to provide comprehensive OAE trainings for professionals in the State of Illinois County Health Departments, Illinois Early Head-Start (EHS) Association, and Illinois Parents as Teachers (PAT) organization. With the assistance of UIC-DSCC, participants were directed to a registration survey formulated by Illinois State University (Appendix C). All-day, OAE training courses were offered for the CY-DD and CY-PR conditions. During registration, participants selected their preferred training date and completed the survey, detailing: participant information, program information, supervisor information, and an estimate of the number of children from age birth to 3 years expecting services. Upon completing the survey, participants were then contacted by an ECHO Coordinator to confirm registration. Following confirmation, participants were provided an introductory letter detailing the location and training agenda.

OAE trainings for the Illinois ECHO program were conducted at the Illinois State University Alumni Center, which is an off-campus multipurpose facility. Courses began promptly

at 9:00 AM and concluded by 4:00 PM. Assessment packets were provided to the students at the beginning of each course. Participants who elected not to participate in an assessment were not provided an evaluation packet. The assessment packets included a disclaimer, pre-training assessment, and post-training assessment. Pre-training assessments were administered prior to the delivery of course instruction. Post-training assessments were completed immediately following the course materials. Participants were not permitted to use any course handouts or reference materials while completing these assessments. Assessment packets were collected immediately following completion of the training, and were assigned a pre-post identification number for tracking purposes.

Retention assessments were provided within a 6 to 12-month time-frame after initial training. When participants became eligible for the retention assessment, a link was sent containing instructions on how to complete the procedure. Participants were discouraged from utilizing any course materials while completing the retention assessment. Attempters were made to email participants no more than three separate occasions within the retention assessment period. Inquiries about the assessment process were managed by an ECHO Coordinator. Retention assessments that were incomplete, or were received following the 12-month cutoff, were excluded from further analysis.

Data Analysis

Part 1

A paired samples t-test was administered to assess knowledge acquisition for all participants, regardless of condition. A comprehensive score was analyzed, as well as subscales

pertaining to knowledge of OAEs, management of protocol and patients, and handling of documentation.

Part 2

A one-way, between-groups, analysis of variance (ANOVA) was used to compare the degree of change in knowledge acquisition between CY-DD and CY-PR conditions. Pre-training and post-training difference scores within each conditions were assessed for comprehensive score, as well as subscales OAE, management of protocol and patients, and handling of documentation.

Part 3

A one-way, between-groups, analysis of variance (ANOVA) was used to compare retention scores between CY-DD and CY-PR conditions. Group retention scores within each conditions were assessed for comprehensive score, as well as subscales OAE, management of protocol and patients, and handling of documentation.

CHAPTER 3

Results

Part 1

A paired-samples t-test (Table 2) indicated a significant difference in pre-training assessment scores (M=9.77, SD=2.40) when compared to post-training assessment scores (M=13.84, SD=1.25) for the comprehensive assessment score; $t(74)= -14.50$, $p < 0.01$. A significant difference in pre-training assessment scores (M=3.73, SD=1.14) versus post-training assessment scores (M=5.59, SD=0.72) for OAE was observed; $t(74)= -12.53$, $p < 0.01$. A significant difference in pre-training assessment scores (M=2.03, SD=0.85) versus post-training assessment scores (M=2.84, SD=0.37) for management of protocol and patients was discovered; $t(74)= -8.14$, $p < 0.01$. Finally, a significant difference in pre-training assessment scores (M=4.01, SD=1.25) when compared to post-training assessment scores (M=5.41, SD=0.79) for handling of documentation was seen; $t(74)= -10.13$, $p < 0.00$. These results provide some evidence that there was a significant increase in knowledge acquisition in comprehensive scores, as well as within each subscale, when using the ECHO Initiative curriculum.

Part 2

A one-way, between-subjects, ANOVA (Table 3) indicated a significant effect between degree of change in OAE subscale score and condition. [$F(1,73)= 4.71$, $p < .03$]. The degree of change in knowledge acquisition scores from CY-DD (M= 2.03, SD= 1.19) were significantly different from CY-PR (M= 1.32, SD= 1.41). There were no observed effects between condition and degree of change in knowledge acquisition score for comprehensive score, management of protocol and patients, or handling of documentation.

Part 3

A one-way, between-subjects, ANOVA (Table 4) indicated a significant effect between OAE subscale retention score and condition. [$F(1,32)= 6.63$, $p < .01$]. Retention scores from CY-DD ($M= 2.76$, $SD= 0.52$) were significantly different from CY-PR ($M= 2.11$, $SD= 0.93$). There were no observed effects between condition and retention score for comprehensive, management of protocol and patients, or handling of documentation.

CHAPTER 4

Discussion

When reviewing results from data analysis, Part 1 showed that a significant improvement in knowledge acquisition was observed from pre-training to post-training for the 75 participants that enrolled in the Illinois ECHO program between 2014 and 2016. An improvement in competencies, as demonstrated by pre-training and post-training assessments, was observed for all subscales. Average scores were significantly higher post-training when compared to pre-training for OAE, management of protocol and patients, and handling of documentation subscales. Significant improvement in comprehensive score was also observed post-training when compared to pre-training.

These outcomes are favorable for the new curriculum developed by the ECHO Initiative and its founding organization, NCHAM. The core competencies of the OAE trainings that were provided by the Illinois State University ECHO program were aligned with the National ECHO curriculum. Upon completion of training, trainees were able to demonstrate improved understanding of OAEs, screening equipment and protocols, proper documentation of test results, and the appropriate management of screened infants, toddlers, and children.

The improved acquisition of knowledge, based on the use of the curriculum, was further validated by classroom observations made during the ECHO program. Attendees of the OAE training noticeably improved their understanding of screening protocols. Regardless of the training model followed, by the end of the educational sessions, participants were able to competently demonstrate the steps necessary for proper administration of the OAE screening. Anecdotally, several participants who attended the ECHO refresher training reported a reduction in the number of children they have had to refer for diagnostic services. These trainees consistently credited the

practical training and troubleshooting techniques that were offered as part of the full-certification course.

Data analysis indicated a significant effect between degree of change in OAE subscale score and condition. Changes in assessment scores pre-training versus post-training for OAE subscale knowledge were greater for CY-DD than for CY-PR. This means that a greater degree of knowledge acquisition was observed immediately following the ECHO program for those that received the didactic based training model, when compared to the practicum based training model. Similar findings were evidenced in the retention data within data analysis of Part 3. Greater retention of knowledge was observed for participants that received the didactic based training model, when compared to the practicum based training model. This was not consistent with the original hypotheses, and no other effects were observed between training models.

Study Limitations

Several factors may have influenced the observed outcomes. First, the depth of the self-assessment items was limited. The pre-training and post-training assessment questions used for this report originated from historical assessments formulated by the IDPH. These assessment questions were not intended to be complex in nature, as many individuals attending ECHO trainings had minimal hands-on OAE screening experience. Nearly all of the participants that attended the ECHO training between 2014 and 2016 had no screening experiences prior to completing the training. When the Illinois State University ECHO Team took over the training program in 2014, a thorough review of prior course materials was conducted, and it was determined that the historical questions were appropriate for the intended population. A limited number of questions were most practical for application within the training schedule. However, with only 15 questions in the self-assessment, the appropriate analysis of each training model could

not be conducted. The size of the participant pool was smaller for CY-PR than CY-DD. This may have further reduced the opportunity to observe a significant difference. Lastly, the self-assessment has not been validated, and the questions were easy enough that the pre-assessment scores were high enough to cause a reduced measureable performance range. Hence, an invalidated, small and unequal sample size, and measurement error, likely reduced expected variance, and diminished any significant effects for CY-PR.

A lack in uptake of the ECHO program was observed over the course of the HRSA grant. Limited responsiveness to OAE training programs was a common theme throughout the entirety of the data collection cycle. As reflected in the data, a clear discrepancy was observed between CY-DD and CY-PR, with 37 more respondents for the CY-DD sample. Following the completion of the CY-DD period, only two new counties in the state of Illinois responded to outreach made by the Illinois State University ECHO Team and UIC-DSCC, and inquired about attending an ECHO program. These counties, in addition to new participants from counties already trained, made up the sample within the CY-PR condition. For the retention portion of the study, twenty-five individuals responded within CY-DD; whereas, nine individuals responded for CY-PR. While a 45% (CY-DD) and 47% (CY-PR) survey response rate for each condition greatly exceeds a minimally-acceptable response rate of 20% (Malhotra & Grovar, 1998), statistical results were likely skewed due to disproportionate enrollment for the latter condition. One of the major drawbacks of the ECHO grant in Illinois has been the inability to fully penetrate market areas with the highest concentration of medical professionals in the need of training.

Future of the ECHO Program

At the close of the data collection period of the ECHO program, 29 of 102 (28.4%) counties in the State of Illinois were serviced with an Illinois ECHO OAE training program. Most agencies contacted were unable to attend, citing issues with accessibility and location of training. These reports are common among agencies. A review of state EHDI programs completed by Houston, Munoz, & Bradham (2011) found that distance is one of the main programmatic barriers to implementing and receiving training. Illinois State University is located in the central part of Illinois, whereas the majority of personnel in need of training are located around the Chicagoland area, two to three hours northeast of our training site. Clearly, it would be beneficial to relocate services closer to the population in need; therefore, a recommendation to move the ECHO training program closer to the Chicagoland area is indicated. This will likely improve market penetration, and, therefore, increase the percentage of population served. Relocation, in conjunction with alternative delivery methods, should also be considered.

The ECHO web-course “Implementing OAE Hearing Screenings and Follow-up with Young Children” delivers an alternative training method that can provide a strong base for knowledge acquisition for a hard to reach population of personnel. The components of this web-based training can provide a new screener with a well-rounded introduction to the same curriculum previously covered during live training. While the web-based training program provides more access to a wider audience, its scope of in-depth competency development may be limited. Success in OAE screening involves understanding and application of procedures. The content of the web-based training approach may address the understanding of OAE fundamentals, but may not be able to address application of OAE screenings.

The appropriate implementation of screening services is based on the ability to utilize correct techniques. Learning structure is beneficial if a participant is able to master and demonstrate each step accurately throughout the screening process. Incorrect associations that are made during the learning process may compromise screening effectiveness in a real-world setting. This may result in higher referral rates from screening. During the data collection cycle, a number of untrained screeners that were attending the ECHO course for the first time reported high referral rates. Face-to-face guidance in the classroom covering proper screening techniques may help to effectively reduce referral rates. As this applies to the web-based training, the necessity of having immediate corrective feedback cannot be overstated. This will require some form of third-party monitoring and screening assistance for those completing the online course. A program proposed by the Illinois State University ECHO Team offered web-conferencing technical support similar to the screening activities implemented in the ECHO training program.

ECHO refresher OAE courses began in 2016. The goal of these courses was to review screening procedures for participants who had previously attended our training. While screeners had maintained the ability to perform screenings, they returned for refresher training with a misunderstanding of the protocol, documentation, and reporting policies. Screeners were not utilizing the screening forms presented during the ECHO training, which included the OAE Screening Form, OAE Diagnostic Follow-up Form, and OAE Screening & Diagnostic Log. In many cases, screeners were being provided forms by their employer or by the State.

In Illinois, use of ECHO documentation is not mandated and varies between screening centers. In order to improve OAE screening courses, a review of training materials should be conducted. Our curriculum had a significant effect on an individual’s understanding of the OAE screening process. Nevertheless, while this curriculum may help a screener learn the components

of OAE screening, the transition to real-world applicability may be limited due to minimal overlap for reporting procedures. If none of the reporting materials recommended by the ECHO Initiative are be utilized in day-to-day practice, then screeners are unable to draw upon what they have learned. In order to address this, ECHO curriculum pertaining to screening components should be fused with State of Illinois specific reporting components. This should improve the effectiveness and overall trainer satisfaction of the ECHO program.

Summary

The validity of the ECHO Initiative curriculum was assessed in this study. A comparison of two training models was routinely analyzed via pre-training and post-training assessment, as well as long-term knowledge retention assessment, in order to determine if any significant differences in program effectiveness might be observed. The Illinois State University ECHO Team provided 75 participants an ECHO OAE training program from 2014 and 2016. Participants were provided a didactic based or practicum based training model using the ECHO Initiative curriculum. Knowledge acquisition was assessed using a pre-training and post-training assessment. Retention was assessed in the months following completion of training using an abbreviated retention assessment tool. Participants were evaluated on their understanding of OAEs, ability to administer protocols, and management of documentation.

Outcomes indicated that our ECHO curriculum had a significant effect on knowledge acquisition for OAE screenings, regardless of training model. Based on pre-training and post-training assessment results, screeners demonstrated markedly improved scores in all aspects of OAE screening upon completion of the program. Functional significance was evidenced, as reports of a declining referral rate have been recently reported by several screening agencies. Over-

referrals contribute to the lost to follow-up rate, which reflects poorly on the State of Illinois. A reduction in referral rates may help to limit the lost to follow-up rate in future reporting.

When analyzing differences between training models, didactic-trained personnel displayed a significant effect on change in assessment score and retention rate, when compared to practicum-trained personnel. No significant effects were observed between training models for comprehensive score, management of protocol and patients, or handling of documentation. The lack of depth in questioning may have prevented the appropriate analysis of change in assessment score as a function of knowledge growth between conditions. An increase in assessment items should be considered, and the disparate sample size between training conditions should be addressed. Based on the target population at the beginning of the study, it was projected that the number of screeners to be trained would remain constant throughout the grant period. As evidenced in the data, the number of personnel enrolled in OAE courses declined significantly, and this occurred when the program changed from the didactic model to the practicum model. These limitations may have affected statistical outcomes.

Alterations should be considered when formulating future installments of the ECHO program. A relocation and restructuring of services is recommended. If the Illinois' ECHO headquarters were moved to the Chicagoland metropolitan area, an improvement in market penetration may be observed. A large percentage of those screeners who were unable to attend resided in the Chicagoland area. For those positioned in rural parts of Illinois, an alternative, web-based training should be considered. A new location of service in conjunction with an alternative delivery method should greatly improve the uptake of the ECHO program.

A change to course curriculum is also necessary. As it has been reported by those that have attended an OAE course, reporting materials that were provided in the ECHO trainings

were not the same as those being implemented in the real-world. In order to address this, the ECHO curriculum should be aligned with reporting components specific to the State of Illinois. These revisions will improve the effectiveness and overall satisfaction of the ECHO Initiative curriculum, and will ensure its future as an educationally effective OAE training program.

LEGENDS

Table 1. Training modules listed by section for CY-PR curriculum.

Table 2. Paired-samples analysis of knowledge acquisition scores.

Table 3. ANOVA comparing changes in knowledge acquisition scores pre-training vs. post-training by conditions.

Table 4. ANOVA comparing retention scores by condition.

Table 1. Training modules listed by section for CY-PR curriculum.

CY-PR Training Modules	
Module (M)	Title
0	Introduction
1	Getting Started
2	Screening Protocol Overview
3	Screening Protocol Overview (P2)
4	Planning Your Screening Program
5	Get to Know Your Equipment
6	Developing Your Screening Skills
7	Developing Your Screening Skills (P2)
8	Strategies for Successful Program
9	Strategies for Successful Program (P2)
10	OAE Protocol in Detail
11	OAE Data Submission is Key
12	Summary and Completion

Table 2. Paired-samples analysis of knowledge acquisition scores.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-training Comprehensive	9.7733	75	2.39692	.27677
	Post-training Comprehensive	13.8400	75	1.25246	.14462
Pair 2	Pre-training OAE	3.7333	75	1.14294	.13198
	Post-training OAE	5.5867	75	.71836	.08295
Pair 3	Pre-training Management	2.0267	75	.85382	.09859
	Post-training Management	2.8400	75	.36907	.04262
Pair 4	Pre-training Documentation	4.0133	75	1.24654	.14394
	Post-training Documentation	5.4133	75	.79003	.09122

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pre-Post Comprehensive	-4.06667	2.42918	.28050	-4.62557	-3.50776	-14.498	74	.000
Pair 2	Pre-Post OAE	-1.85333	1.28077	.14789	-2.14801	-1.55866	-12.532	74	.000
Pair 3	Pre-Post Management	-.81333	.86514	.09990	-1.01238	-.61428	-8.142	74	.000
Pair 4	Pre-Post Documentation	-1.40000	1.19684	.13820	-1.67537	-1.12463	-10.130	74	.000

Table 3. ANOVA comparing changes in knowledge acquisition scores pre-training vs. post-training by conditions.

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Degree of Change in Comprehensive Score	CY-DD	56	4.3214	2.38257	.31838	3.6834	4.9595	.00	11.00
	CY-PR	19	3.3158	2.47325	.56740	2.1237	4.5079	.00	7.00
	Total	75	4.0667	2.42918	.28050	3.5078	4.6256	.00	11.00
Degree of Change in OAE Score	CY-DD	56	2.0357	1.19033	.15906	1.7169	2.3545	.00	5.00
	CY-PR	19	1.3158	1.41628	.32492	.6332	1.9984	-1.00	4.00
	Total	75	1.8533	1.28077	.14789	1.5587	2.1480	-1.00	5.00
Degree of Change in Management Score	CY-DD	56	.8571	.88273	.11796	.6207	1.0935	-1.00	3.00
	CY-PR	19	.6842	.82007	.18814	.2889	1.0795	.00	2.00
	Total	75	.8133	.86514	.09990	.6143	1.0124	-1.00	3.00
Degree of Change in Documentation	CY-DD	56	1.4286	1.21890	.16288	1.1021	1.7550	-1.00	5.00
	CY-PR	19	1.3158	1.15723	.26549	.7580	1.8736	.00	3.00
	Total	75	1.4000	1.19684	.13820	1.1246	1.6754	-1.00	5.00

Table 3 (continued). ANOVA comparing changes in knowledge acquisition scores pre-training vs. post-training by conditions.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Degree of Change in Comprehensive Score	Between Groups	14.347	1	14.347	2.480	.120
	Within Groups	422.320	73	5.785		
	Total	436.667	74			
Degree of Change in OAE Score	Between Groups	7.353	1	7.353	4.707	.033
	Within Groups	114.034	73	1.562		
	Total	121.387	74			
Degree of Change in Management Score	Between Groups	.424	1	.424	.563	.455
	Within Groups	54.962	73	.753		
	Total	55.387	74			
Degree of Change in Documentation	Between Groups	.180	1	.180	.124	.725
	Within Groups	105.820	73	1.450		
	Total	106.000	74			

Table 4. ANOVA comparing retention scores by condition.

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Comprehensive Retention	CY-DD	25	6.8400	1.24766	.24953	6.3250	7.3550	4.00	8.00
	CY-PR	9	6.3333	1.32288	.44096	5.3165	7.3502	4.00	8.00
	Total	34	6.7059	1.26801	.21746	6.2635	7.1483	4.00	8.00
OAE Retention	CY-DD	25	2.7600	.52281	.10456	2.5442	2.9758	1.00	3.00
	CY-PR	9	2.1111	.92796	.30932	1.3978	2.8244	1.00	3.00
	Total	34	2.5882	.70141	.12029	2.3435	2.8330	1.00	3.00
Management Retention	CY-DD	25	1.7200	.45826	.09165	1.5308	1.9092	1.00	2.00
	CY-PR	9	1.5556	.52705	.17568	1.1504	1.9607	1.00	2.00
	Total	34	1.6765	.47486	.08144	1.5108	1.8422	1.00	2.00
Documentation Retention	CY-DD	25	2.3600	.75719	.15144	2.0474	2.6726	1.00	3.00
	CY-PR	9	2.6667	.50000	.16667	2.2823	3.0510	2.00	3.00
	Total	34	2.4412	.70458	.12083	2.1953	2.6870	1.00	3.00

Table 4 (continued). ANOVA comparing retention scores by condition.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Comprehensive Retention	Between Groups	1.699	1	1.699	1.058	.311
	Within Groups	51.360	32	1.605		
	Total	53.059	33			
OAE Retention	Between Groups	2.786	1	2.786	6.630	.015
	Within Groups	13.449	32	.420		
	Total	16.235	33			
Management Retention	Between Groups	.179	1	.179	.789	.381
	Within Groups	7.262	32	.227		
	Total	7.441	33			
Documentation Retention	Between Groups	.622	1	.622	1.264	.269
	Within Groups	15.760	32	.493		
	Total	16.382	33			

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APPENDICES

Appendix A

Pre-training and Post-training Assessment

1. How many children are born annually with permanent hearing loss in the United States?
    A. 1 in 100
    B. 1 in 200
    C. 1 in 300
    D. 1 in 400
2. Most children with permanent hearing loss:
    A. Have parents who do have a hearing loss
    B. Have parents who do not have a hearing loss
    C. Use cochlear implants
    D. Need pressure equalization tubes
3. What population(s) is the ECHO Initiative trying to address?
    A. Children not screened at birth
    B. Children that are lost to follow-up
    C. Children that acquire post-neonatal hearing loss
    D. All of the above
4. An OAE Screening:
    A. Involves a behavioral response
    B. Requires the child be awake and alert
    C. Is an objective test
    D. Is provided by most physicians
5. The otoacoustic emission (OAE) is a response from which part of the ear?
    A. Eardrum
    B. Cochlea
    C. Auditory Nerve
    D. Ossicles
6. When conducting an OAE screening, which ear(s) of a child should be screened?
    A. Either ear is fine
    B. The ear with less ear wax
    C. Both ears
    D. Whichever ear the teacher/parent thinks is the child’s better ear
7. The screener is responsible for all of the following except:
    A. Re-screening following the treatment for an ear infection
    B. Diagnosing hearing loss
    C. Educating parents about the importance of hearing to a young child

D. Providing a medical referral

8. When selecting the tip size for a screening, it is best to:
    A. Begin with the smallest available size
    B. Choose a size slightly smaller than the ear canal opening
    C. Begin with the largest available size
    D. Choose a size slightly larger than the ear canal
9. If a child is uncooperative and consistently displaces the probe from the ear canal during the initial screening session, you should:
    A. Hold the probe firmly in the ear canal while screening
    B. Try to screen the child again during nap time
    C. Refer the child immediately to the audiologist
    D. Attempt to screen him/her the following year
10. You are visually inspecting a child's ear prior to screening and notice there is ear wax completely blocking the ear canal. What would you do?
    A. Document the ear wax and proceed with the screening
    B. Adjust the screening equipment
    C. Try and remove the ear wax yourself
    D. Refer for medical follow-up
11. If a child has an ear infection and accompanying fluid in the middle ear, you would expect that they:
    A. Would pass the OAE screening
    B. Would not pass the OAE screening
    C. Would usually be identified easily without OAE screening
    D. Wouldn't have any difficulty hearing
12. How many OAE screenings are conducted prior to a middle ear consultation? (assuming that the child passes visual inspection)
    A. 1
    B. 2
    C. 4
    D. It's not your role as a screener to refer a middle ear consultation
13. If a child is referred from a screening and then is seen by a healthcare provider and treated for an ear infection, you should:
    A. Rescreen the child in 4-6 weeks
    B. Repeat the screening only if concerns arise
    C. Refer the child immediately to an audiologist
    D. No further action is needed
14. If excessive noise is present while you are trying to conduct the screening:
    A. It will take longer to complete the screening

B. A larger probe tip should be used
C. A smaller probe tip should be used
D. The equipment will increase the volume of the stimulus

15. What is the final step in the documentation process for OAE screenings at your facility?
A. Filling out an OAE Hearing Screening Form
B. Inputting all results into the OAE Screening & Diagnostic Log
C. Filling out a Diagnostic Follow-up Form
D. Dumping all collected information

Appendix B

Retention Assessment

Please enter the ECHO ID where prompted below, then answer the 9 questions prior to submitting the survey. Please refrain from using prior course materials or external sources.

1. Please enter the provided ECHO ID (ex: A99)
2. Most children with permanent hearing loss:
    a. Have parents who do have a hearing loss
    b. Have parents who do not have a hearing loss
    c. Use cochlear implants
    d. Need pressure equalization tubes
3. An OAE Screening:
    a. Involves a behavioral response
    b. Requires the child be awake and alert
    c. Is an objective test
    d. Is provided by most physicians
4. The otoacoustic emission (OAE) is a response from which part of the ear?
    a. Eardrum
    b. Cochlea
    c. Auditory Nerve
    d. Ossicles
5. If a child is uncooperative and consistently displaces the probe from the ear canal during the initial screening session, you should:
    a. Hold the probe firmly in the ear canal while screening
    b. Try to screen the child again during nap time
    c. Refer the child immediately to the audiologist
    d. Attempt to screen him/her the following year
6. When selecting the tip size for a screening, it is best to:
    a. Begin with the smallest available size
    b. Choose a size slightly smaller than the ear canal opening
    c. Begin with the largest available size
    d. Choose a size slightly larger than the ear canal
7. When conducting an OAE screening, which ear(s) of a child should be screened?
    a. Either ear is fine
    b. The ear with less ear wax
    c. Both ears
    d. Whichever ear the teacher/parent thinks is the child’s better ear
8. How many OAE screenings are conducted prior to a middle ear consultation? (assuming that the child passes visual inspection)
    a. 1
    b. 2

   c. 4
   d. It’s not your role as a screener to refer a middle ear consultation

9. What is the final step in the documentation process for OAE screenings at your facility?
   a. Filling out an OAE Hearing Screening Form
   b. Inputting all results into the OAE Screening & Diagnostic Log
   c. Filling out a Diagnostic Follow-up Form
   d. Dumping all collected information

10. Please provide a conservative estimate of how many OAE screenings you have conducted since being trained

Appendix C

Registration Survey

Part 1

Are you new to OAE hearing screenings, or need a refresher after a previous training? Attend a free workshop held at Illinois State University in Normal, IL. This training is sponsored by the Illinois Early Hearing Detection and Intervention Program at UIC-Division of Specialized Care for Children! These workshops are intended to make you comfortable with the screening and data-entry process, and will feature a combination of face-to-face training and hands-on experience. By the end of the workshop, you should demonstrate knowledge that includes an understanding of hearing loss in children, the OAE screening process, the documentation process, and how to handle common screening problems. Full-certification training workshops will be held from 9:00 AM to 4:00 PM, with a one-hour break from 12:00 PM to 1:00 PM (lunch is not provided, but there are restaurants nearby). Re-certification/review training workshops will be held from 9:00 AM to 12:00 PM.

To register for a workshop, please fill out the following information at your earliest convenience. A confirmation email will be sent within five business days with information about location, parking, and staff. Any questions involving the registration process can be directed to ECHO@ilstu.edu.

Part 2

1. Please select which training session you would like to attend.
2. Please provide your contact information:
    a. Participant Name
    b. Program Name
    c. Address
    d. Address 2
    e. City/Town
    f. ZIP/Postal Code
    g. County
    h. Email Address
    i. Phone Number
3. Please provide your supervisor’s contact information.
    a. Supervisor Name
    b. Supervisor Email Address
4. Select the program model that best describes you (Select all that apply).
    a. Health Department
    b. Early Head Start Program
    c. Parents as Teachers Program
    d. MCHIEV
    e. Health Families Illinois

   f. Prevention Initiative
   g. Other (Please specify)
5. Please provide a conservative estimate of the number of children birth to 3 years of age that you expect to provide direct OAE hearing screening services.