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# 2017 Student Research Day

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Friday April 28  
12:15-5:00 pm  
Kirkland Auditorium  
and West Lobby,  
UNC-CH School of  
Dentistry

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Division of Speech and  
Hearing Sciences,  
Department of Allied Health  
Sciences, University of North  
Carolina at Chapel Hill

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# Ninth Annual Division of Speech and Hearing Sciences Student Research Day

Friday April 28, 2017  
12:15 – 5:00pm  
University of North Carolina – Chapel Hill  
Kirkland Auditorium and West Lobby

## Welcoming Remarks, Presentation of the Robert W. Peters Award for Research Mentoring

Dr. Jackson Roush 12:15 – 12:30

## Oral Presentations: 2<sup>nd</sup> year Ph.D. Students

1. Ashwaq Alzamel 12:30 – 12:50  
*Sex & IQ as Predictors of Sensory Patterns in Children with ASD*
2. Michaela Dubay 12:50 – 1:10  
*In Search of Culturally Appropriate Autism Interventions for Latino Families*
3. Lisa Erwin-Davidson 1:10 – 1:30  
*Classroom Transformation upon the Infusion of a Symbolic Communication Intervention:  
Year 1 Results*
4. Thelma Uzonyi 1:30 – 1:50  
*Measuring Transactional Engagement Among Infants at-risk for Autism*

## Poster Session 1 (16 posters)

1:50 – 2:50

1. Alissa Hopper, Irene Romero, Brooke Steinwascher  
*Identifying Comorbid Hearing Loss and Autism Spectrum Disorders in Children*
2. Skye Dorsett, Marisa Marsteller, Melissa Simpson  
*Tele-audiology: Implications and Practitioners Perceptions*
3. Emily Bragg, Cece Benitez, Amanda Coats  
*Effects of Respiratory Muscle Strength Training and Shaker Exercise on Swallow Function:  
A Systematic Review*
4. Jenna Hall, Carolina Valder  
*Phonemic Errors and Phonetic Distortions after Left Hemisphere Stroke*
5. Alex Stewart, Marissa Kobylas

*A Systematic Review of the Efficacy of Phonics-Based Literacy Interventions for Children with Hearing Loss*

6. Megan Frey, Jordan Potosky, Lisa Copeland  
*Systematic Review of Management of Children with ANSD*
7. Sarah Griffin  
*Variability of Diagnostic Symptoms of ASD in Individuals with Fragile X Syndrome*
8. Melanie Frost, Jasmine Wilson, Katharina Boyce  
*Cognitive Retraining Therapy and Tinnitus Retraining Therapy Outcomes: A Systematic Review*
9. Taylor Petroski  
*Phonemic and Phonetic Errors in Conduction Aphasia*
10. Samantha Baker, Shauna Dool, Emily Spitzer  
*Efficacy of school-based hearing conservation programs: A systematic review*
11. Ruthy Xu, Laura Strenk  
*Interventions for Minimally Verbal School-Aged Children with Autism Spectrum Disorders: A Systematic Review*
12. Michael Smith, Katarina Haley & Julie Wambaugh  
*Phonemic Error Analysis: Edit Distance Instead of Error Rate*
13. Chad Shannon, Lena Wedeen  
*Systematic Review of Noninvasive Brain Stimulation In Language Rehabilitation*
14. Margaret Richter  
*Subjective Outcomes after Cochlear Implantation in Cases of Unilateral Hearing Loss*
15. Evan Fischer, Adrienne Pearson  
*Bone-Anchored Hearing Aids on Speech-in-Noise and Localization Tasks in Children with Unilateral Hearing Loss: A Systematic Review*
16. Lorraine Osborne, Meredith Anderson, Margaret Dillon,  
*Influence of Stimulation Rate on Speech Perception in Older Adult Cochlear Implant Recipients*

**Break** (switch posters, transition to auditorium)

2:50 – 3:00

## Oral Presentations: 1<sup>st</sup> year Ph.D. Students

1. Jonet Artis 3:00 – 3:20  
*Is There A Relationship between Early Parent Concerns and a Later Developmental Disorder Diagnosis?*
2. Kathryn Dorney 3:20 – 3:40  
*Impact of Project Core on the Communication Skills of Pre-linguistic Preschool Students with ASD*
3. Jenni Shafer 3:40 – 4:00  
*Access Barriers to Outpatient Rehabilitative Therapy after Stroke: Implications for the Speech-Language Pathologist*

## Poster Session 2 (16 posters)

4:00 – 5:00

1. Shakeia Burgin, Anna Zembo  
*A Systematic Literature Review of the Impact of Self-Regulation Intervention Strategies on Social Communication Outcomes*
2. Megan Frey  
*Factors Affecting Successful Adoption of Connectivity Devices by Hearing Aid Users*
3. Michael Smith, Matthew Suderman  
*A Summary of Peer-Reviewed Psychometric Evaluations of Assessments for Post-Stroke Aphasia*
4. Tayler Simonds, Michelle Swanson, Ian Kim  
*Impact of Sleep on Speech and Language Outcomes Following Stroke*
5. Jordan Jarrett  
*Word Repetition and Continuous Speech Analyses in Primary Progressive Aphasia*
6. Caroline Traub, Ashley Gyori  
*The Effects of Electronic Versus Print Books on the Language Outcomes of Early Readers*
7. Michelle Fronzaglia, Lily Radack  
*A Systematic Review of Music Interventions for Dementia*
8. Kelly Allison, Hollis Elmore, Kelsey Roy  
*A Systematic Review of The Impact of Hearing Aid Use on Depression in Adults*
9. Karson Moore, Emma Gibbings  
*Influence of Hearing Aids on Speech and Language of Children with Mild Hearing Loss: A Systematic Review*

10. Lisa Copeland  
*Hearing Loss and Comorbidities in Children with Cytomegalovirus (CMV)*
11. Ginni Lam, Lisa Dombay  
*A Task-Based Assessment of Academic English Pronunciation*
12. Lorraine Osborne, Mariana Valverde, Caitlyn Whitson,  
*Cochlear implantation in children under twelve months: A systematic review*
13. Kelly Allison, Skye Dorsett, Marisa Marsteller, Melissa Simpson  
*Outpatient Re-screening of Newborn Infants Using ABR and OAE*
14. Rebecca Sukhu, Kendra Thomas  
*Best Practice in Feeding for Children with Pierre Robin Sequence*
15. Sam Lebold, Morgan McGowan, Kalie Mitchell  
*Does Kangaroo Mother Care have an impact on breastfeeding or oral feeding readiness measures in preterm infants? A systematic review.*
16. Abigail Messinger, Morgan Billinger, Tyler Dwyer  
*Language Outcomes in Bilingual Individuals with Dementia: A Systematic Review*

Ashwaq Alzamel

Faculty mentors: E. Crais, L. Watson, G. Baranek

*Sex & IQ as Predictors of Sensory Patterns in Children with ASD*

### **Purpose**

This study aims to examine the effect of sex and IQ on sensory response patterns in children with ASD.

### **Background**

Females with autism spectrum disorder (ASD) are at a higher risk of being missed or identified later in life than their male counterparts. This underrepresentation of females in ASD may be a result of male-bias related to the understanding of autism symptoms, diagnostic practice, or female protective effect. This delay in diagnosis prevents females from accessing essential intervention services at earlier stages of development. Limited studies have been done to investigate into the underlying differences in ASD phenotype between the sexes, specifically in the presentation of sensory response patterns. These sensory responses, including hypo-responsiveness (HYPO), hyper-responsiveness (HYPER), seeking behaviors (SEEK), and enhanced perception (EP), impact the child's language, adaptive skills, and overall quality of life. Additionally, recent findings suggest that Intellectual Quotient (IQ) is negatively correlated with increased sensory responses. Previous studies of sensory behaviors in children with ASD did not include a sufficient number of females to adequately examine potential sex differences.

### **Methods**

This study used existing data from a large longitudinal study. Caregivers of children with ASD, aged 2-12 years old, participated in a national online survey investigating longitudinal outcomes of sensory behaviors. The national survey study collected data at two time points, but only time point 1 data were used in the current analysis. The survey included a background questionnaire (including parent report of cognitive functioning converted to a proxy IQ; IQP) and the Sensory Experiences Questionnaire (SEQ.v3). Only children (n=1125) that had a reported IQP were included in the analysis (females n=196 and males n =929). Controlling for chronological age, a regression model (sex\*IQP) was employed to examine sex and IQP as predictors of sensory patterns.

### **Results**

Sex was found to be a significant predictor of HYPO ( $p < .0152$ ) and SEEK ( $p < .0218$ ), but not HYPER ( $p < .44$ ) or EP ( $p < .68$ ). Moreover, there was an interaction between sex and IQP ( $p < .0125$ ) indicating that females with lower IQP scored higher on HYPO behaviors than males at the same level of IQP. However, males scored higher on HYPO behaviors than females in higher levels of IQP. A similar pattern was found with SEEK ( $p < .0063$ ) where females with lower IQP had more seeking behaviors in comparison to males. In contrast, males scored higher on SEEK behaviors than females in higher levels of IQP. Additionally, IQP had a significant correlation with HYPER ( $p < .0008$ ), indicating that children with higher IQP show more sensory hyper-responsiveness, but sex was not significantly associated with HYPER. A similar pattern was observed with EP ( $p < .0001$ ), showing that children with higher IQP have more sensory enhanced perception, regardless of their sex.

### **Discussion**

This novel study investigated sex differences in sensory response patterns in children with ASD. These results provide important insight on understanding sensory behaviors in females across different levels of IQP, suggesting that females with lower IQP tend to have more HYPO and/or SEEK behaviors than their counterpart males. In contrast, females with higher IQP show less HYPO and/or SEEK than males with comparable IQP. These findings have implications for diagnosis and intervention that reflect the unique sensory differences between the sexes.

Michaela DuBay

Faculty mentor: Linda Watson

*In Search of Culturally Appropriate Autism Interventions for Latino Families*

**Purpose**

1) What are the differences in the ways that non-Latino White (NLW) and Latino Spanish-speaking (LSS) parents perceive the quality and family-centeredness of intervention they are currently receiving or have received? 2) What are the overall perceptions of the feasibility, appropriateness, and acceptability of evidence-based practices in ASD intervention among LSS parents of children with ASD?

**Background**

Latinos represent the fastest growing minority population in the United States, and the proportion of Latino children with autism spectrum disorder (ASD) in early intervention programs (i.e., for children birth to 5 years of age) shows concomitant increases. Despite these changing demographics, the vast majority of evidence-based ASD interventions have been designed for and tested with mostly White, mid-upper class, monolingual English-speaking populations. Unfortunately, research suggests that interventions that are incongruent with a target population's culture may be less effective. To either adapt current evidence-based interventions or design new interventions for Latino populations, we must have input from members of the Latino community, including knowledge of families' perceptions of intervention models and components of evidence-based practices.

**Methods**

Non-Latino white English-speaking (n=25) and Latino Spanish-speaking (n=27) parents of young children with ASD completed two surveys regarding their perception of their child's current services, including family's strengths/needs and family involvement. Additionally, Latino Spanish-speaking parents and other caregivers of young children with ASD (n = 20) shared perspectives of their child's interventions through focus groups. Topics of discussion included parents' level of involvement in therapy, perceptions of caregiver-mediated intervention models, as well as the feasibility, acceptability, and appropriateness of a number of several prominent evidence-based ASD interventions (prompting, video modeling, naturalistic interventions, and discrete trials) in the context of their own family.

**Results**

Contrary to expectations, survey results indicate that NLW parents report that intervention is less helpful in teaching parents to help their child develop and learn compared to LSS parents ( $t = 2.11$ ;  $p < .05$ ). However, LSS parents reported having fewer friends or family to rely on for support ( $t = 2.48$ ;  $p < .05$ ). Focus group participants reported a wide range of levels of involvement in therapy and perceptions of the benefits or drawbacks for specific intervention strategies. Thematic analyses revealed that all parents wanted training and education on how to carry out interventions in the home environment even when children receive intervention in the school setting. Parents also shared positive perceptions of strategies such as prompting, using positive reinforcement, and verbal responsiveness. Parents were less positive about strategies involving wait time or sabotage, however they noted that a variety of strategies are required to meet the child's range of daily therapeutic needs.

**Discussion**

Findings suggest a need to provide specific, ongoing caregiver training and support to families of children with ASD, even for parents of preschool and school-age children. Specific strategies to culturally adapt interventions will be discussed.

Lisa Erwin-Davidson

Faculty mentor: Karen Erickson

*Classroom Transformation upon the Infusion of a Symbolic Communication Intervention:  
Year 1 Results*

**Purpose:** The purpose of this intrinsic case study was to thoroughly document and analyze communication and the various ways it changed over an eight-month period upon the infusion of a novel symbolic communication intervention in a special education classroom. Prior to the introduction of this research-informed symbolic communication intervention, the seven children, ages 7 – 10 had no prior means of symbolic communication. Furthermore, there was no classroom-based or teacher-focused systematic intervention in place to help these students develop symbolic communication skills.

**Background:** This case study is embedded within a larger study (Project Core) designed to help teachers learn how to teach symbolic communication to students who have significant cognitive disabilities and complex communication needs. This study fills an important gap in the literature of augmentative and alternative communication for this population of children, and adds evidence to the larger study regarding how symbolic communication emerged within a self-contained special education classroom. The 36 core symbols described herein have classroom-wide applicability, and the communication intervention approach, is informed by research evidence and practices as defined for the system for augmenting language (SAL: Romski & Sevcik, 1996; Romski, Sevcik, Cheslock, & Barton, 2006).

**Methods:** The unit of analysis in this intrinsic case study is a self-contained elementary special education classroom set within a public separate school. There are seven students, one main teacher, one assistant, and related service providers. Triangulation of data was conducted through analysis of: (1) 20 sets of observational field notes, (2) semi-structured and informal interviews, and (3) classroom artifacts (e.g., work samples, communication supports, instructional resources). Multiple points of view were elicited. Data was sorted and organized to develop themes and central ideas and analyzed using approaches described by Lichtman (2013) and Yin (2014). A researcher-developed (Erwin-Davidson, L. & Erwin-Davidson, S., 2016) content analysis of the semi-structured interviews was utilized to extract and identify key sentiments that helped support evidence of thought and action change over time.

**Results:** Infusing a small set of 36 highly useful words, represented symbolically, into the existing daily activities of a self-contained special education classroom revealed a co-development of communication, instructional, and contextual components within the classroom. By having a predictable, useful, and mutually referenced set of words that served as a common platform of communication, there was an increase in student engagement, teacher-student attunement, and group cohesiveness. The teacher and her assistant more frequently attributed meaning to the students' symbolic communication attempts and became more natural in their ability to embed these common words across topics and contexts. Finally, the students in this classroom were given more reasons to communicate as the teacher realized how to share this common form of language representation.

**Discussion:** These results add evidence to our larger study suggesting that providing access to an evidence-based, flexible, and broadly applicable core vocabulary (small set of highly useful, conceptually based words represented graphically) allows students with significant cognitive disabilities to improve communicative competence and symbolic communication.



Thelma Uzonyi,

Faculty mentor: Betsy Crais

*Measuring Transactional Engagement Among Infants at-risk for Autism*

**Purpose:** The purpose of this study was to apply a transactional model in measuring the initiation and types of behaviors within cycles of communication that occur between mothers and their infants who were at-risk for autism spectrum disorder (ASD). These cycles will be called established transactional engagement (ETE) occurrences, where at least three turn-taking actions occur. *Aim 1:* Identify the proportion of established transactional engagement (ETE) occurrences within parent-infant dyads, in comparison to other permutations of interactions (initiation only or initiation-response only interactions). *Aim 2:* Determine if variation in the initiator or the type of initiation increases the likelihood of the completion of an ETE occurrence.

**Background:** Parent-infant engagement, specifically longitudinal transactional processes between an infant and parent, have great influence on the successful acquisition of language and communicative behavior (Tamis-LeMonda et al., 2001; Wetherby, Warren & Reichle, 1998). As such, transactional processes are of particular interest in ASD studies because engagement is a noted area of impairment for children with ASD (APA, 2013), and parents' responsiveness to their infants is thought to improve children's communicative and engagement behavior (Haebig et al. 2013; Siller & Sigman, 2002, 2008). However, few studies have investigated the moment-to-moment transactional exchanges within the parent-infant dyad, specifically within a population of infants at-risk for ASD.

**Methods:** This study used extant data obtained from the Early Development Project-2 at UNC-Chapel Hill (Watson et al., under review). Thirty parent-infant free play videos were randomly selected from the 87 parent-infant dyads available at time 1 data collection. The coding scheme from the "Partial Interval Time Sampling of Adaptive Strategies for the Useful Speech Project" (Yoder et al., 2010) was adapted to capture the establishment of transactional engagement in the parent-infant play videos. Videos were coded on Observer XT software using time interval sampling with intervals defined at 7.5 seconds (80 intervals total).

**Results:** *Aim 1:* Of the coded parent-infant behaviors, 37% were ETE occurrences, 21% were initiation-response only interactions and 24% were initiation only. Another engagement pattern emerged from the data indicating a "misfire" (partner A initiated, partner B redirected partner A, and then partner A joined in with partner B to the redirected engagement activity). Misfires accounted for 18% of interactions. *Aim 2:* When controlling for the action used to initiate the interaction, results show that an initiation lead by the adult increases the likelihood of ETE ( $p=0.052$ ), whereas using touch initiation with an object instead of a look initiation has no effect on the likelihood of ETE ( $p=0.913$ ). Assigning fixed and random effects by participant revealed strong support ( $p=0.00$ ) for parent led interactions having a higher likelihood of resulting in an ETE than a child led initiation by roughly 60%. *Additional analysis:* An increase in (logged) misfires increases the likelihood of an infant having a later diagnosis of ASD on the ADOS ( $p=0.041$ ). However, total ETE occurrences have no discernable effect on the likelihood of a child's later ADOS score ( $p=0.111$ ). Contrary to its relationship with ADOS, an increase in (logged) misfires decreases the likelihood of a child scoring in the severe deficiency range of the SRS ( $p=0.008$ ).

**Discussion:** The results of this study show an early look at engagement patterns present between parents and their infants who are at-risk for ASD. Findings indicate parents' initiating behavior as a strong indicator of ETE occurrences. The presence of "misfires" warrants further research into whether these breakdowns were repaired into ETE occurrences, and their differencing effects on ADOS and SRS assessments.

Alissa Hopper, Irene Romero, Brooke Steinwascher

Faculty mentor: Linda Watson

*Identifying Comorbid Hearing Loss and Autism Spectrum Disorders in Children*

### **Purpose**

What evidence-based practices are currently available for identifying children with dual diagnoses of Autism Spectrum Disorder (ASD) and hearing loss?

### **Background**

Despite the evidence that hearing loss (HL) is more prevalent in people with Autism Spectrum Disorders (ASD) than in the general population, very little research is available to provide clinical providers with tools and evidence-based practices to identify Autism Spectrum Disorders in children with hearing loss and vice-versa.

### **Methods**

The authors conducted a systematic review of peer-reviewed journal articles published between January 1, 2007 and January 31, 2017 and available in English. The authors used the following databases in the search: CINAHL, PubMed, ERIC, PsycInfo. The search terms were (autis\* OR ASD OR "Autism Spectrum Disorder" OR Asperger\* OR "Pervasive Developmental Disorder" OR PDD\*) AND ("hearing loss" OR deaf\* OR "hearing impair\*" OR "hard of hearing") AND (diagnos\* OR screen\* OR identif\* OR assess\*). Two authors independently reviewed each article for inclusion or exclusion based on the following criteria: the article addressed the pediatric population (21 and younger), the article addressed comorbid hearing loss and autism spectrum disorder, and the article discussed methods or tools for identifying or diagnosing either hearing loss or autism spectrum disorder. First the authors reviewed articles by title and abstract only and then by full text. Articles that were not empirical in nature were excluded. Two authors independently completed an article appraisal for each article that met all inclusion/exclusion criteria. Two authors independently completed data extraction for each article.

### **Results**

Few studies have examined the pediatric population with comorbid hearing loss and autism spectrum disorder. There is an absence of standardized procedures and tools appropriate for use in screening and diagnosis with this population. However, several small studies have found tools and techniques that hold promise as screens, red flags, and important information to observe and consider when evaluating a child for hearing loss and autism spectrum disorder.

### **Discussion**

With the implementation of newborn hearing screenings, early identification of hearing loss has improved. However, because some characteristics of young, typically developing deaf children can resemble characteristics of children with autism spectrum disorders, identification of autism spectrum disorders in the deaf population is often delayed. Existing evaluations for diagnosis of autism spectrum disorders among the hearing population are inadequate for diagnosis in the population with hearing loss. Studies have indicated several adaptations to and applications of existing assessments as well as observational red flags that can help distinguish between behaviors attributable to hearing loss and those characteristic of autism spectrum disorders. An obstacle to producing a standardized assessment tool for this population is the small population size. It is important that a professional with experience in both pediatric hearing loss and pediatric autism spectrum disorder use all available information to diagnose the presence of both of these disorders in an individual.

Skye Dorsett, Marisa Marsteller, Melissa Simpson Faculty mentors: Watson, Steinbrenner  
*Tele-audiology: Implications and Practitioners' Perceptions*

**Purpose:** The purpose of this systematic review is to examine audiologists' perceptions of tele-audiology and how tele-audiology is being implemented.

**Background:** Telemedicine, and specifically tele-audiology, is a potential option to provide families and patients with hearing loss access to diagnostic and treatment services when there are access barriers. Tele-audiology originated from previous telemedicine programs dating back to the early 1960s and the utilization currently allows for hearing care practice to provide virtual care. It is important to consider how practitioners view this option for providing care and also to investigate how it is being implemented to determine which aspect of audiology telemedicine is best suited for.

**Methods:** Article searches were performed in PubMed and CINAHL databases. Search criteria included articles published from June 2009 until January 2017 and any format other than case study designs. Reliability calculations were performed during the title/abstract review and the full text review. We ultimately decided to exclude any article not discussing tele-audiology practice in the United States during the full-text review. Sixteen articles were included for quality appraisal.

**Results:** Tele-audiology is being implemented for various age populations and various diagnostic and intervention needs. The results suggest that most audiologists are comfortable with the technology needed to implement tele-audiology but not as many are in fact utilizing it in their practice.

**Discussion:** Since tele-audiology practice is a relatively new service option, there needs to be more research performed in the United States about how many audiologists are utilizing it and to what extent. For those programs with established tele-audiology service options, the outlook is generally positive and these sites are using it for both diagnostic and intervention services. For those sites that have not yet started to implement tele-audiology, this may be useful for those patients where access to in-person care is not convenient.

Emily Bragg, Cece Benitez, Amanda Coats      Faculty mentors: Watson & Steinbrenner  
*Effects of Respiratory Muscle Strength Training and Shaker Exercise on Swallow Function: A Systematic Review*

**Research Question:** In adult patients with dysphagia, how does the Shaker exercise compare to Respiratory Muscle Strength Training (RMST) in improving functional outcomes of swallowing?

**Background:** Oropharyngeal dysphagia is a dysfunction of swallowing which can affect the ability of a bolus to move from the oral cavity through and into the esophagus (Clavé and Shaker, 2015). This is a common issue among individuals with neurologic conditions as well as elderly adults and can cause complications such as aspiration pneumonia, malnutrition, dehydration, and possibly death (Clavé and Shaker, 2015). Effective treatment strategies should be utilized to reduce the risk of these complications and improve the overall quality of life for individuals with dysphagia. This current study explores two leading therapy exercises that are being used to improve the symptoms of oropharyngeal dysphagia: Respiratory Muscle Strength Training (RMST) and the Shaker Exercise (also commonly referred to as head lift). RMST is an exercise technique that targets the inspiratory and expiratory muscles to increase force generation and has been shown to have effects on breathing, swallowing, and cough (Sapienza et al. 2011). The Shaker exercise focuses on strengthening the suprahyoid and infrahyoid muscles to promote upper esophageal sphincter (UES) opening (Don Kim et al. 2015). The purpose of this study is to understand how the Shaker Exercise compares to the Respiratory Muscle Strength Training in improving functional outcomes of swallowing in adult patients with dysphagia.

**Materials and Methods:** We identified published peer-reviewed articles addressing the effects of RMST and the Shaker exercise in three databases: PsychInfo, CINAHL Plus, and PubMed. The inclusion criteria were as follows: English language, peer-reviewed, involved adult participants with dysphagia, utilizes the head lift/Shaker exercise and/or RMST, IMST, or EMST, measured the effects on swallowing, and publication prior to February 14, 2017.

**Results:** Of the 178 articles identified using the initial search terms, 43 were included based on title and abstract review. The results were narrowed to 15 studies following full text review, and were fully appraised by reviewers independently using the Joanna Briggs Institute Quality Appraisal Checklists. All differences in appraisals were resolved through discussion and further analysis of the articles. The articles ranged from poor to high quality. Studies included in the review consist of 10 randomized controlled trials (RCT), 4 quasi-experimental studies (non-randomized experimental studies), and 1 systematic review. Nine studies analyzed the effects of the Shaker exercise and six studies analyzed the effects of RMST. The results indicated that both exercise techniques have different, yet positive effects on the swallowing mechanism and may reduce the risk of complications associated with dysphagia.

**Discussion:** The aim of this review is to better understand how the Shaker method compares to RMST in improving functional outcomes of swallowing. The results of this synthesis may have useful clinical implications for determining patient candidacy for these exercises. However, most studies did not determine the lasting effects of the exercise and only measured the outcomes after a 4-6 week trial period. This indicates a greater need for higher quality, randomized controlled trials with longer follow-up periods to determine if these functional outcomes persist over time.

Jenna Hall, Carolina Valder

Faculty mentor: Katarina Haley

*Phonemic Errors and Phonetic Distortions after Left Hemisphere Stroke*

### **Purpose**

The purpose of this study was to determine the frequency of phonetic distortions and phonemic errors in speech samples collected from 26 individuals, 16 of whom were left hemisphere stroke survivors and 10 of whom did not have any brain lesions. We also aimed to determine the correlation between phonetic and phonemic errors in the 16 speakers who had suffered a stroke.

### **Background**

Left hemisphere stroke often results in aphasia, which can co-occur with both apraxia of speech (AOS) and phonemic paraphasia (APP). AOS and APP have similar presentations, so it is important to strengthen criteria and understanding of the clinical differentiation between the disorders. AOS is a motor speech disorder characterized by a slow speaking rate and the presence of distortions and distorted substitutions, while APP is characterized by phonemic errors such as the deletion, addition, and/or substitution of phonemes. Phonetic distortion errors are linked theoretically only to AOS and their presence is one of two core criteria for differential diagnosis between AOS and APP (Haley et al., 2017).

### **Methods**

After completing an introductory phonetics course, the authors were further trained in narrow phonetic transcription. Transcription was completed using Klattese, a variation of phonetic transcription that incorporates computer readable symbols, and the software Praat. Twelve diacritic marks were used to identify distortions. A new diacritic was introduced each week, allowing time for transcribers to properly train their ears. Discussion of the practice samples was allowed and encouraged to establish reliability in the authors' perception of sub-phonemic variation. Once an appropriate level of confidence was established, the investigators independently transcribed speech samples from 26 speakers. They were told the samples were from people with left hemisphere stroke but were not informed some were from a control group without brain lesions.

### **Results**

Only one author's results are currently available. Once both authors have analyzed their data, we predict a moderate to strong correlation between findings. Regarding the first author's data, the average proportion of phonetic distortions produced by speakers who had a stroke was 4% for each speaker (range: 1% - 9%) and the average proportion of phonemic errors produced was 14% (range: 3% - 43%). For normal speakers, the average proportion of phonetic distortions produced was 1% for each speaker (range: 0% - 5%) and the average proportion of phonemic errors was 1% (range: 0% - 2%). Within the group of speakers who had a stroke, there was a moderate correlation ( $r = 0.60$ ) between the frequency of phonetic distortions and phonemic errors. A t-test showed that the frequency of distortion errors differed significantly between the two groups, as did the proportion of word accuracy ( $p \leq .002$ ).

### **Discussion**

The correlation between the frequency of phonetic distortion errors and phonemic errors in individuals who have suffered from left hemisphere stroke replicates previous studies. It is encouraging that the distortion rates were different for the stroke group and the control group. Reasons for the relatively low distortion values in the stroke group should be explored.

Alex Stewart & Marissa Kobylas

Faculty mentors: Watson & Steinbrenner

*A Systematic Review of the Efficacy of Phonics-Based Literacy Interventions for Children with Hearing Loss*

### **Research Question**

For this systematic review, the researchers aimed to address the following question: "What is the efficacy of phonics-based literacy interventions for school age children with hearing loss?"

### **Background**

Phonemic awareness is defined as, "the ability to notice, think about, and work with the individual sounds in words" while phonics is "the understanding that there is a predictable relationship between phonemes... and graphemes" (National Reading Panel 2000). The reading difficulties that are seen in children who are deaf and hard of hearing may be closely connected to the inability to adequately address the phonological components of reading instruction, especially phonemic awareness and phonics skills (Leybaert, 1993). According to the most recent data from the National Center for Educational Statistics (2013), approximately 75% of children with hearing impairments spend 40% or more of their day in the regular education classroom. As Trezek (2007) discussed, "given this current placement arrangement, coupled with the move toward instructional strategies that include phonemic awareness and phonic skills, identifying successful means of accessing this type of instruction for students who are deaf or hard of hearing is critical." Despite this need, there are currently no published systematic reviews on phonics-based literacy intervention for school age children with hearing loss.

### **Methods/Proposed Methods**

Five databases (CINAHL, ERIC, PsycINFO, Education Full Text, PubMed) were searched using the following terms: *hearing loss, hearing impairment, deaf, hard of hearing, phonics, phonemic awareness, phonological awareness, phoneme-grapheme, sound awareness, grapheme-phoneme, letter sound awareness, letter sound correspondence, letter knowledge*. Studies were excluded if the participants used sign as their primary form of communication or were older than elementary school-age, and if the study was written in a language other than English. The initial search produced 148 articles in total. The team members completed title-abstract reviews, including independent and blinded title-abstract reviews on 34% of the articles with a reliability of 94%. The researchers then independently and blindly reviewed the full 13 remaining articles, attaining a reliability of 85%. The researchers completed quality appraisal of the 7 articles included in this review using the Joanna Briggs Appraisal Checklists.

### **Results/Anticipated Results**

Quality appraisals revealed an overall lack of high-quality studies completed in the area of phonics-based literacy intervention for children with hearing loss. The systematic search resulted in only case-control, case series, and case report study designs. Furthermore, the methodologies of the studies were rated as moderate quality at best, with two studies rated as adequate. Full results will be drawn from data extraction, which has not yet been completed.

### **Discussion**

Conclusions and clinical implications based on the results will be discussed. A major finding based on the systematic search and quality appraisals is a lack of studies regarding literacy interventions for children with hearing loss, especially related to phonics-based interventions. More research should be completed in this area in order to fully evaluate the efficacy of phonics-based (and other types) of literacy interventions for children with hearing loss.

Megan Frey, Jordan Potosky, & Lisa Copeland  
*Systematic Review of Management of Children with ANSD*

Faculty mentor: Linda Watson

### **Research Questions**

In children with ANSD, how does amplification compared to cochlear implantation affect speech and language outcomes?

### **Background**

Auditory Neuropathy Spectrum Disorder, or ANSD is a sensorineural hearing loss characterized by an impairment of the auditory nerve. This generally means that while sound is able to travel through the outer, middle, and inner ear, it is unable to successfully reach the brain. Cochlear Implants (CIs) and hearing aids have both become common interventions for children with ANSD. The purpose of this systematic review is to investigate differences in speech and language outcomes between the two interventions.

### **Methods**

A literature search was conducted using the following search string: (ANSD OR CND OR Auditory Neuropathy OR Cochlear Nerve Deficiency) AND (children OR pediatric OR school) AND (amplification OR Hearing aids OR hearing amplification OR acoustic stimulation) AND (cochlear implant\* OR electric stimulation). Three major databases were searched; PubMed, Ovid, and MedlinePlus. Studies including speech and language outcomes of this population of children were included. Exclusion criteria included children with comorbidities, non-English speaking populations, and studies that only considered academic achievement outcomes. Twelve studies met the inclusion criteria by addressing one or more of the aspects of our research questions. Eleven of the 12 studies addressed the use of cochlear implantation, and 5 addressed the use of hearing aids. Studies were evaluated for quality using the Cincinnati Children's LEGEND Appraisal Forms. Data regarding participant, intervention, and outcome variables are reported.

### **Results**

All studies included were observational in design, including cohort studies and comparisons between children with ANSD and SNHL. The literature supports both hearing aids and CIs as acceptable intervention measures for ANSD. Evidence of favorable outcomes were demonstrated for both types of intervention in children with ANSD. Speech and language outcomes for both the hearing aid subjects and cochlear implant subjects were similar. All participants showed an improved auditory performance to some degree, yet all 12 studies were considered exploratory with methodological limitations and confounding issues.

### **Discussion**

Due to the wide variety of outcomes for children with ANSD, it is important to identify children who will benefit from amplification and those who are appropriate candidates for cochlear implantation. The clinical evidence determining the differences in speech and language outcomes between CI and HA interventions in the ANSD population is limited. Stronger evidence is needed to demonstrate any important differences in cochlear implant benefit compared to hearing aid benefit as it pertains to speech and language outcomes in children with ANSD.

Sarah Griffin

Faculty mentor: Margaret DeRamus

*Variability of Diagnostic Symptoms of ASD in Individuals with Fragile X Syndrome*

### **Purpose**

In 2013, the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-V)* provided a new framework of criteria for diagnosing autism spectrum disorder (ASD), differing from the previous edition, the *DSM-IV*, in both structure of criteria and number of criteria needed for a diagnosis. This study aims to further understand the relationship that exists between specific ASD symptoms observed and the presence of an ASD diagnosis in this population.

### **Background**

A recent analysis of this data (DeRamus et al., 2016) demonstrated that more individuals with FXS met criteria for ASD on the *ADOS-2* when mapped to the diagnostic framework of *DSM-IV* than that of *DSM-V*. This current exploratory study is a sub-analysis of data obtained by the Decisional Capacity in fragile X syndrome study at the UNC-CH Carolina Institute for Developmental Disabilities and Research Triangle Institute and examines symptoms of autism through the gold-standard behavioral assessment for ASD, the *ADOS-2*.

### **Methods**

One method for exploring the differences between diagnoses resulting from *DSM-IV* vs *DSM-V* criteria is to look at a relaxed version of *DSM-V* criteria, reducing the number of qualifying symptoms by one in both social communication and interaction (SCI) and repetitive and restricted behaviors and interests (RRBI) criteria. The symptoms of ASD in 143 individuals with FXS (72 male and 71 female) from the *ADOS-2* were examined with regards to the criteria of SCI and RRBI. In addition, frequencies of meeting criteria for ASD based on a relaxed diagnostic criteria of the *DSM-V* standards were examined.

### **Results**

75% of males and 21% of females met SCI criteria under *DSM-V* criteria, while 87% of males and 64% of females met SCI criteria under relaxed *DSM-V* criteria. 59% of males and 21% of females met RRBI criteria under *DSM-V*; however, 89% of males and 64% of females met RRBI under relaxed *DSM-V* criteria. Overall, 56% of males and 16% of females met criteria for ASD under *DSM-V*, and 79% of males and 50% of females met criteria for ASD under relaxed *DSM-V* criteria. When only the SCI criterion was relaxed by one qualifying symptom, 59% of males and 19% of females met criteria for ASD. When only the RRBI criterion was relaxed by one qualifying symptom, 72% of males and 37% of females met criteria for ASD.

### **Discussion**

There is a larger increase for both males (16% higher) and females (21% higher) meeting criteria when the RRBI criterion is relaxed by one qualifying symptom as compared to when the SCI criterion is relaxed by one qualifying symptom (3% higher for male and females). Further analysis will be done to determine the significance of these differences and to look into the sub-criteria within the SCI and RRBI domains. Examination of the ASD symptomatic profile of individuals with FXS is important to the understanding of diagnostic trends and the focus of further treatment due to funding constraints on services covered by insurance.



Melanie Frost, Jasmine Wilson, Katharina Boyce Faculty mentors: Steinbrenner, Watson  
*Cognitive Retraining Therapy and Tinnitus Retraining Therapy Outcomes - A Systematic Review*

### **Research Question**

In adults with tinnitus, does cognitive behavioral therapy or tinnitus retraining therapy reduce symptoms and/or improve quality of life compared to adults with tinnitus who receive no intervention?

### **Background**

Tinnitus is defined as the perception of sound in the absence of external sound. Prevalence estimates are highly variable and are likely to increase with age as the prevalence of hearing loss increases, due to the association between the two conditions. Although tinnitus is highly correlated with hearing loss, many sufferers of tinnitus have measurably normal hearing. For some, tinnitus can become debilitating, interfering with quality of life and contributing to a cyclical relationship with depression and anxiety. Historically, many treatments for tinnitus have been explored, often with unsatisfactory results. However, for two of the most well-studied treatments, tinnitus retraining therapy (TRT) and cognitive behavioral therapy (CBT), research has shown evidence of symptom reduction and improvements of quality of life for tinnitus sufferers.

### **Methods/Proposed Methods**

This systematic review aims to analyze and compare outcomes for two of the most common treatments for tinnitus, cognitive behavioral therapy (CBT) and tinnitus retraining therapy (TRT), compared to no intervention for the treatment of subjective tinnitus. A search of literature in peer-reviewed journals from PubMed and PsychInfo databases between the years of 2006-2017 yielded 21 high-quality studies evaluating outcomes for CBT and/or TRT in the 18 and older population.

### **Results**

Full analysis of data is currently in progress and will be incorporated upon completion.

### **Discussion**

Outcome measures were heterogeneous, underscoring the need for future research using standardized questionnaires for the purposes of comparison analysis.

Taylor Petroski  
*Phonemic and Phonetic Errors in Conduction Aphasia*

Faculty mentor: Katarina Haley

### **Purpose**

The purpose of this study was to characterize the relationship between phonemic and phonetic errors in conduction aphasia (CA) as well as the quality of these errors.

### **Background**

CA is a type of fluent aphasia that is characterized by phonological difficulties and substantial repetition difficulties in the context of relatively spared language functions in other areas. The clinical diagnosis of CA is often based on the Western Aphasia Profile (WAB), which is one of the most popular aphasia batteries due to its ease of administration and relatively objective scoring. The most challenging subtest score for this instrument is the fluency rating. The scale takes into consideration multiple dimensions, including phrase length, grammatical competence, and paraphasias of spontaneous speech. A score of 5-10 means the patient has fluent aphasia while a score of 1-4 indicates nonfluent aphasia. Because CA is a fluent type of aphasia, it requires a fluency rating greater than 4. However, people who are recovering from other presentation profiles may also receive this rating and a WAB diagnosis of CA due to persistent repetition difficulties. This may happen even if the presentation profile is not qualitatively indicative of the CA syndrome. Further examination of phonological difficulties can help identify the subset of people who have a more classic CA profile as those who present a high frequency of phonemic errors and a low frequency of phonetic distortion errors. By definition, the relationship between distortion errors and phonemic errors should be low in this population.

### **Methods**

The speech samples for this study came from AphasiaBank (<http://talkbank.org/AphasiaBank/>). 41 individuals classified as having CA on the WAB were given the Boston Naming Test (BNT), which includes a list of 15 words. The author transcribed each of the 615 words using a narrow transcription protocol with 12 diacritic marks. The frequency of omissions, additions, and substitutions were then compiled and supplemented by calculation of the edit distance between broad transcription of the target and observed production. Additionally, distortion type and frequency was evaluated for the data compilation.

### **Results**

The results were consistent both with the clinical characterization of CA and the prediction that the relationship between distortion errors and phonemic errors would be low. The mean proportion of segments with phonemic errors was 61.79% while the mean proportion of distortion errors was 5.28%. The correlation between the two was low ( $r=0.16$ ). Other results to note were the mean frequency of distorted substitutions, which was very low at 1.74%, and the frequencies of substitutions (20.44%), additions (4.50%), and omissions (11.60%).

### **Discussion**

As a group, these participants produced relatively high frequencies of sound errors without the distortion quality that is considered typical of motor speech disorders, including apraxia of speech (AOS). We are currently examining the results to determine whether a subset of the 41 speakers had a classic CA profile, with high phonemic error rate and low distortion error rate, whereas others may have presented with more evidence of a motor speech disorder (especially AOS). Additionally, we anticipate that further analysis of the specific distortion qualities will advance our understanding of what is characteristic of the CA profile.

Samantha Baker, Shauna Dool, Emily Spitzer      Faculty mentors: Watson & Steinbrenner  
*Efficacy of school-based hearing conservation programs: A systematic review*

**Purpose:**

The purpose of this systematic review was to examine the quantity and quality of evidence related to the following question: How effective are school-based hearing conservation programs?

**Background:**

Noise-induced hearing loss (NIHL) is a serious issue for adults exposed to loud sounds in their workplace, such as soldiers or factory workers. Previous research has demonstrated that hearing conservation programs aimed at educating workers about the dangers of loud noise and the use of hearing protection reduces NIHL and helps promote a safer workplace. Children are also at risk for NIHL due to increases in mp3 player use and more crowded classrooms with less favorable acoustics. Fewer hearing conservation programs exist for children, and the effectiveness of them is not well known.

**Method:**

Articles from PubMed and CINAHL that appeared in peer-reviewed academic journals were included in the analyses. Search terms included "hearing conservation," hearing prevention," "school," and "child." Studies have been reviewed twice at multiple levels, including title and abstract, full text, and quality appraisal. At the end of this process, there are seven articles left for data extraction and analysis.

**Anticipated Results:**

Overall results will include outcome measures such as reduction in NIHL, hearing conservation program acceptance, and change in hearing conservation behaviors among school aged children.

**Discussion:**

This study will be helpful to audiologists or school administrators considering implementation of these programs by systematically assessing the value of hearing conservation for children.

Ruthy Xu and Laura Strenk

Faculty mentors: Watson, Steinbrenner, DuBay

*Interventions for Minimally Verbal School-Aged Children with Autism Spectrum Disorders: A Systematic Review*

**Research Questions:** For minimally verbal school-aged children who have been diagnosed with Autism Spectrum Disorder, what intervention techniques have evidence of efficacy in improving communication?

**Background**

The diagnosis of Autism Spectrum Disorder (ASD) has been on the rise in recent years, with a prevalence as high as 1 in 45 children. Currently, the vast majority of research on children with ASD is focused on the preschool-age population and higher-functioning older children. Despite the fact that 25-30% of children with ASD remain minimally verbal through school-age, research in the speech-language field on treatment methods for this subset of children is lacking. In this paper, we aim to assess the quality and outcomes of the literature on this topic through a systematic review of current research on intervention strategies for minimally verbal children between 5-17 years old. We examined the definitions of minimally-verbal and low-functioning in the ASD population, as well as evidence for intervention efficacy in promoting communication.

**Methods**

In this systematic review, a comprehensive literature search was conducted in three databases - - PsycInfo, PubMed and CINAHL. This search yielded 485 articles published between January 1996 and January 2017. Titles, abstracts, and/or full-texts were independently assessed by two reviewers in order to determine inclusion, and ultimately 15 articles fit the inclusion criteria for this study. Published appraisal tools were used by two independent reviewers in order to determine the quality of the 15 articles in this review.

**Anticipated Results**

Of the 15 articles in this systematic review, 8 had small single-subject designs. Of the articles remaining, 5 were randomized controlled trials and 2 were systematic reviews. It is anticipated that there will be moderate support for the use of alternative and augmentative communication, such as the Picture Exchange Communication System (PECS), for school-aged children who remain minimally verbal. Further details about the results will be available when analyses are completed.

**Discussion**

The current review supports the continued need for further research investigating the most efficacious communication interventions for minimally verbal school-aged children with ASD. While there has been a surge in research over the past 6 years addressing this gap in the literature, many studies have been small and yielded weak results.

Michael Smith, Katarina Haley & Julie Wambaugh

Faculty mentor: Katarina Haley

*Phonemic Error Analysis: Edit Distance Instead of Phonemic Error Rate*

### **Purpose**

The purpose of this study was to determine convergent validity of edit distance and manual phoneme-level analysis in the quantification of phonemic errors.

### **Background**

The proportion of words produced without any errors, is often used as a convenient index of articulatory severity (Haley et al., 2012; Duffy et al., 2017). Phoneme-level analysis is far more precise in its report of the frequency of substitution, omission, and addition errors that a person makes when speaking (Cunningham et al., 2016; Haley et al., 2001; Odell et al., 1990, 1991; Strand et al., 2014). It is, however, time-consuming, in that it requires consistent judgments about error type and manual calculation, making applications limited. In this study, we apply an edit distance metric to compute the similarity automatically. The Levenshtein distance, the simplest of edit distances, quantifies the difference between two strings by summing the fewest number of omissions, additions, and substitutions required to transform one string into another. Previous applications in the area of linguistics have been used to quantify the difference between languages or dialects (Thije & Zeevaert, 2007).

### **Methods**

We analyzed two retrospective speech samples. The first sample consisted of 24 speakers with AOS who repeated 27 words with varied length and phonetic complexity on a motor speech evaluation (Duffy, 2013). The second sample consisted of 41 speakers with a WAB-based diagnosis of conduction aphasia who named 15 pictures while completing the short-form Boston Naming Test (Kaplan et al., 2001). For each word, we computed the edit distance and manual phoneme-level analysis. Edit distance was calculated using an online calculator (Holsinger, 2017), and the sum of the edit distance for all attempted words was divided by the total number of phonemes produced. Phonemic error rate calculations were completed by manually counting the frequency of omissions, additions, and substitutions and again dividing this sum by the total number of phonemes produced.

### **Results**

Convergent validity for the edit distance was excellent, as demonstrated by a negligible mean difference between the edit distance and phoneme-level analysis and a near perfect correlation between the two analyses.

### **Discussion**

Not only is convergent validity high for applications of the edit distance to phonemic analysis in people with aphasia and apraxia of speech; the measure is also more time-efficient and not vulnerable to user error. Because omissions, additions, and substitutions are counted independently, difficult clinical decisions must be made when counting phonemic errors manually. Due to the convenience of automated calculation and potential for inclusion in transcription software, clinical application is highly feasible and would extend to any area for which phonemic analysis is relevant, which includes a variety of speech production disorders in children and adults.

Chad Shannon and Lena Wedeen

Faculty mentors: Watson & Steinbrenner

*Systematic Review of Noninvasive Brain Stimulation In Language Rehabilitation*

## **Research Question**

In adults with communicative impairments, are noninvasive brain stimulation techniques (i.e. Transcranial Direct Current and Magnetic Stimulations) in conjunction with traditional interventions more effective than traditional interventions alone when treating and rehabilitating acquired communication and literacy deficits?

## **Background**

Due to the lack of substantive structural intervention in the event of language impairment, the aim of the present systematic review is to procedurally assess studies in which noninvasive brain stimulation, in conjunction with traditional treatments, is used to rehabilitate language and communication.

## **Methods**

A systematic search of noninvasive brain stimulation studies was carried out using predefined search strings in 5 databases. The initial search resulted in 111 articles, which were then independently assessed to determine relevance based on the inclusion/exclusion criteria. Patients must have been eighteen years of age or older and have suffered a cerebrovascular accident. Then, quality appraisals were completed on the remaining articles. Data from the selected studies will be extracted and then synthesized into a comprehensive evaluation of the efficacy of noninvasive brain stimulation in language rehabilitation treatments.

## **Results**

The systematic review includes 6 articles; 2 randomized control trials, 2 clinical control trials, and 2 quality improvement studies. 6 out of 6 articles were rated as high quality, with an inter-rater reliability of 85%. Current research indicates a potentially positive effect of noninvasive brain stimulation when coupled with more traditional treatments. This manifests as an improved ability to name objects and engage in the fundamentals of language; however, further study is necessary regarding the placement of both anodes and cathodes and supplementary intervention.

## **Discussion**

Transcranial direct stimulation and transcranial magnetic stimulation may represent a novel and significantly beneficial structural supplement to traditional intervention. While more research is necessary to properly differentiate between the efficacy of tDCS and TMS, as well as the ideal placement of the anodal/cathodal array, this systematic review aims to serve as a foundation for evidence-based practice in the use of noninvasive brain stimulation to help rehabilitate language, especially in a post-stroke population.

Margaret Richter

Faculty mentor: Margaret Dillon

*Subjective Outcomes after Cochlear Implantation in Cases of Unilateral Hearing Loss*

**Purpose or Research Questions:** The aim of this study is to observe subjective benefit of cochlear implantation in cases of unilateral hearing loss.

**Background:** Unilateral hearing loss (UHL) is defined as a condition where an individual has significant hearing loss in one ear with the contralateral ear possessing normal audiometric function. In some cases, patients with UHL receive limited benefit from amplification in the affected ear. This population faces difficulties in accessing binaural cues to help with localization and speech perception in noisy environments. Current treatment options for patients with UHL include CROS hearing aids and bone-conduction devices. In a CROS hearing aid configuration, a microphone is placed on the poorer ear and the signal is routed to a receiver on the better-hearing ear. Unfortunately, this device cannot decipher between background noise and the signal that the individual wants to hear, potentially resulting in the background noise being amplified over the desired signal. The CROS hearing aid also does not improve localization. Bone-conduction devices may include noninvasive options, such as the TransEAR, or an implantable device, such as the bone-anchored hearing aid (BAHA). These devices present the signal from the poorer hearing ear to the better hearing ear via transcutaneous stimulation. Unfortunately, there is also limited data supporting the localization benefit for bone-conduction devices as the signal is only presented to one ear. The current study examines cochlear implantation as a treatment option for patients with UHL. The cochlear implant stimulates the auditory pathway of the poorer hearing ear, potentially improving speech perception in noise and localization. Previous studies have examined this treatment; however, the methods and outcomes have been variable. This report examines the subjective benefit experienced by recipients as reported on measures of quality of life.

**Methods/Proposed Methods:** Twenty subjects underwent cochlear implantation as part of a FDA clinical trial investigating speech perception, localization, and quality of life with a CI in cases of UHL. All subjects were implanted with the MED-EL CONCERT standard electrode array and were fit with OPUS2 audio processor. Subjects completed quality of life measures at the preoperative, and 1, 3, 6, and 9-month post-initial activation intervals. Quality of life questionnaires included the Speech, Spatial, and Qualities of Hearing Scale (SSQ) and the Tinnitus Handicap Inventory (THI).

**Results:** When analyzing the SSQ, subjects reported an improvement in their abilities within the initial months of CI listening experience. Data were analyzed using a repeated-measures ANOVA. Subjects demonstrated a significant improvement in the total score, as well as the Speech, Spatial, and Qualities of hearing subscales. When analyzing the THI, all subjects reported an improvement in the perceived severity of their tinnitus when listening with the CI as compared to the preoperative severity level. There is also a significant improvement in the reported severity of the tinnitus over time.

**Discussion:** Cochlear implant recipients reported a significant improvement in their quality of life when listening to the CI plus the normal to near-normal hearing ear. A significant improvement was found on the SSQ and THI after 1 month of CI listening experience. Subjects reported improved sound awareness and ability to understand speech in noise when listening with the CI plus the normal to near-normal hearing ear. Subjects reported the tinnitus to be minimized or no longer present when listening with the CI. Cochlear implantation in cases of moderate-to-profound unilateral hearing loss may be a viable treatment option.

Evan Fischer, Adrienne Pearson

Faculty mentors: Watson, Steinbrenner

*Bone-Anchored Hearing Aids on Speech-in-Noise and Localization Tasks in Children with Unilateral Hearing Loss: A Systematic Review*

## **Purpose**

The purpose of this systematic review is aimed to examine the current literature and findings to determine if use of intervention with a bone-anchored hearing aid (BAHA) in children with unilateral hearing loss leads to improved localization and speech in noise test results over no intervention.

## **Background**

Many studies have demonstrated that children with unilateral hearing loss may struggle both academically as well as behaviorally. These studies have also found that people with UHL demonstrate greater difficulty in noisy situations than normal hearing peers. There remains limited data on the efficacy of different treatment options for unilateral hearing loss (UHL) in children, however. One such option is a surgically placed BAHA. This is typically only recommended in cases of profound unilateral hearing loss and is currently only approved for use in adults and in children ages 5 and older.

## **Methods**

We conducted a systematic review using the search strategy (BAHA OR bone anchored hearing aid) AND (localization OR "speech in noise") AND child\* AND (UHL or unilateral hearing loss) on two databases, Pubmed and CINAHL, while using Google Scholar as a supplementary database. We restricted our publication dates of articles used from anytime-March 2017. Our exclusion criteria included case studies, expert opinion articles, participants over 18, non-English studies, cochlear implants or hearing aids, and bilateral hearing loss.

## **Anticipated Results**

We expect to find little research in this area, but also expect to find some positive findings that a BAHA will be beneficial for children with UHL in speech in noise and localization tests.

## **Discussion**

While there was some evidence of benefit and no evidence of detriment in the use of a BAHA to treat children with UHL, the lack of high quality research indicates that larger and more in depth studies are needed.



Lorraine Osborne, Meredith Anderson, Margaret Dillon      Faculty mentor: Meredith Anderson  
*Influence of Stimulation Rate on Speech Perception in Older Adult Cochlear Implant Recipients*

### **Purpose**

Manipulation of cochlear implant (CI) map features, such as stimulation rate, may influence the recipient's speech perception with the device. It is unknown whether manipulation of specific map features may be beneficial considering the recipient's age. The present report reviewed whether age at implantation was related to speech perception outcomes resulting from adjustments to stimulation rate.

### **Background**

Cochlear implantation is indicated for adults with moderate to profound sensorineural hearing loss who demonstrate limited benefit from conventional hearing aids. Post-lingually deafened adults typically experience an improvement in speech perception within the first 6 months of cochlear implant use (Lenarz et al 2012). Comparisons between younger and older adult cochlear implant recipients demonstrate a difference in speech perception within the first year of device use (Vermeire et al. 2005; Chatelin et al. 2004). The stimulation rate is the number of pulses per second presented by the cochlear implant; adjustments to this programming parameter have been shown to influence speech perception (Friesen et al. 2005; Verschuur 2003). Clinicians may lower the stimulation rate to attempt to improve speech perception in poorer performing older adults; however, there are limited studies to support this idea. The aim of the present report is to assess whether adjustments to the stimulation rate influence speech perception in older adults within the first year of device use.

### **Methods**

This prospective study enrolled post-lingual cochlear implant candidates who were 65 years of age or older at the time of cochlear implantation. All subjects were implanted with the MED-EL cochlear implant system. Speech perception was assessed with CNC words in quiet, AzBio sentences in a 10-talker babble (+10 dB SNR), and BKB-SIN. At the 6-month interval, subjects with a CNC word score of less than or equal to 50% correct were randomized into one of two groups: 1) stimulation rate unchanged, or 2) stimulation rate lowered. The rate of stimulation was not adjusted for subjects with a CNC word score of greater than 50% correct. Speech perception results at the 12-month interval were compared between the three groups to assess the role of stimulation on outcomes.

### **Results**

Fifteen subjects enrolled and were followed over the first year of listening experience. The age at implantation ranged from 66 to 81 years, with an average of 76 years. Six subjects had a CNC word score of greater than 50% at the 6-month interval, and thus did not have their stimulation rate adjusted. Of the nine subjects who scored less than or equal to 50% at the 6-month interval, five were randomized to the stimulation rate unchanged group and four were randomized to the stimulation rate lowered group. There was a trend for better speech perception at the 12-month interval for subjects whose stimulation was lowered as compared to those whose stimulation rate was unchanged.

### **Discussion**

Differences between the groups were noted at the 12-month interval. Adjustments to the stimulation rate may result in improved speech perception performance for poorer performing older adults. Review of long-term listening experience is needed to further assess how perception abilities change over time.

Jonet Artis

Faculty mentor: Linda Watson

*Is there a relationship between early parent concerns and a later developmental disorder diagnosis?*

### **Research Questions**

Question 1: To what extent do parents of preschoolers diagnosed with a developmental disorder (DD) vary in their likeliness to report a concern and the number of the concerns reported at 12 months compared to parents of children not diagnosed?

Question 2: To what extent do parents of preschoolers diagnosed with a DD vary in their likeliness to report a concern and the number of concerns reported at 24 months compared to parents of children not diagnosed?

Question 3: Are there differences between race (e.g. Black/African American and White) in the likeliness, types, and number of concerns expressed by parents when children are matched by parental education?

### **Background**

Some parents of children later diagnosed with autism or other DD are able to express concerns for their child's development when the child is 12 months old (Ozonoff et al., 2009). However, the exact age at which the parent concerns are indicative of a disorder is not clear. In addition, parents of different races/ethnicities are able to accurately report concerns (Glascoe, 1997). However, black children are more likely to be diagnosed with another disorder before they are diagnosed with autism when compared to white children (Mandell, 2007). Therefore, it is of interest to investigate if parents of different races/ethnicities differ in their expression of concerns in ways that may account for variability in the diagnostic history.

### **Proposed Methods**

The First Year Inventory (FYI) is a screening tool used to determine if a child presents at risk for autism at 12 months of age (Reznick et al., 2007). It includes 2 open-ended questions about parental concerns. Using extant data from approximately 650 parents who completed both the FYI at 12 months and a Developmental Concerns Questionnaire (DCQ) at 24 months, we will compare the responses of parents of 3-year-olds diagnosed with a disorder (n=43) and parents whose children were not diagnosed with a disorder. First, we will conduct chi-squared analysis to determine if there are any group differences in likeliness to report a concern. Next, we will compare groups on the average number of concerns reported. We will complete these analyses for both 12 and 24 months. We will also use a subset of FYIs to analyze responses to the two open ended questions about parental concerns from an equal number of black and white parents, matching the sample by parent education level. We will then compare the two groups based on likeliness of any concern, types of concerns, and average number of concerns.

### **Anticipated Results**

Parents of children diagnosed with any DD by age 3 will have been more likely to express concerns on the FYI at 12 months and on the DCQ at 24 months than parents of children with no DD. Race will impact the type and number of responses on the FYI.

### **Discussion (potential contribution of anticipated results)**

Findings about the timing and nature of parent expressions of developmental concerns about children later diagnosed with a DD and about potential racial/ethnic differences in the expression of parental concerns may have implications for approaches to screening and referral to achieve more equitable and earlier identification of ASD and other DDs.

Kathryn Dorney,

Faculty mentor: Karen Erickson

*Impact of Project Core on the Communication Skills of Pre-linguistic Preschool Students with ASD*

**Purpose:** The purpose of the proposed study is to examine the factors that promote changes in symbolic communication skills of preschool students with autism spectrum disorder (ASD) after implementation of Project Core, which is a framework for AAC intervention.

**Background:** This case study is embedded within the larger Project Core study designed to help teachers learn how to teach symbolic language to students with significant cognitive disabilities and complex communication needs. The preschool students in this study have an educational classification of autism spectrum disorder. At the onset of the study, none of the child participants could use speech, signs or symbols to meet their communication needs. The teachers volunteered to participate in a yearlong intervention focused on teaching them to integrate and support the use of core vocabulary as an approach to AAC. This study will fill an important gap in the AAC literature, as research regarding the use of core vocabulary with students with ASD is limited. Core vocabulary has wide application to the multiple components of language with the flexibility to be used across contexts and settings. Use of core vocabulary with the Project Core framework is informed by research evidence and practices as defined for the system for augmenting language (SAL: Ronski & Sevcik, 1996; Ronski, Sevcik, Cheslock, & Barton, 2006; Ronski, Sevcik, Cheslock, & Barton- Husley, 2017).

**Proposed Methods:** A mixed-method case study will be conducted with three self-contained preschool classrooms within a self-contained special education school. Participants include twenty students ages 3-5 years old, three main teachers, three teacher aides, and related service providers. The Communication Matrix (Rowland, 2012) was administered at pretest and posttest. Results will be analyzed using repeated measures ANOVA procedures. Qualitative analysis will involve: (1) 29 sets of observational field notes, (2) interviews with teachers and related service providers and (3) classroom artifacts (e.g., communication supports and instructional resources). Data will be sorted and organized to identify themes and central ideas and analyzed using approaches described by Glaser and Strauss (1992) and Yin (2014).

**Anticipated Results:** With access to ongoing instruction and access to flexible functional core words, it is expected that the children will improve their level of symbolic communication. It is also expected that the adults will increase their modeling of the use of core vocabulary and attributing meaning to child communication acts. Further exploration will be needed to examine how the interaction between the adults and children enhance the communication of all participants.

**Discussion:** These results will inform the overall Project Core study by providing information regarding teacher use of core vocabulary within an evidence-based instructional framework to enhance the communication skills of preschool students with ASD.

Jenni Shafer

Faculty mentor: Katarina Haley

*Access Barriers to Outpatient Rehabilitative Therapy after Stroke: Implications for the Speech-Language Pathologist*

### **Purpose**

The purpose of this study is to identify access barriers to outpatient rehabilitative care after stroke. Our objective is to identify and understand the following key domains: 1) financial barriers to accessing outpatient rehabilitative care after stroke; 2) non-financial barriers to accessing outpatient rehabilitative care after stroke

### **Background**

While stroke remains a leading cause of death, more people are surviving stroke due to better acute management (Sacco & Dong, 2014)]. However, lower mortality rates also mean an increasing number of stroke survivors, many of whom are living with disabilities (CDC, n.d.). Access to outpatient rehabilitative care allows stroke survivors to bridge the gap from inpatient care to reintegration into the community, but improving survival rates mean little if such care is not accessible (Smith, 2015). Unfortunately, many stroke survivors are dissatisfied with the amount of outpatient care received and report frustration with the information they receive regarding care (Ostwald et al., 2009). They also perceive a lack of support, which is not surprising given that outpatient rehabilitative care is a salient factor to community reintegration and can help decrease the isolation that many stroke survivors face (Godwin et al., 2013). Therapy limits compound feelings of distress when patients feel that therapy has ended before they are ready (Ostwald et al., 2009).

### **Methods**

We conducted focus groups with stroke survivors, caregivers, hospital administrators, and clinicians to identify barriers to accessing outpatient rehabilitative care after stroke. All participants were recruited via email and invited to participate in one of five one-hour focus groups sessions (four including stroke survivors and/or caregivers [n=29], one including hospital administrators and clinicians [n=7]). Two of the authors and a research assistant completed initial descriptive coding as part of a content analysis [10]. Initial codes and thematic impressions were discussed and agreement among the coders was reached. Additional codes that materialized from the data were discussed and agreed upon by the authors [10]. Analyses were conducted in Atlas.ti.

### **Results**

The results are organized broadly into two main groupings—financial and non-financial access barriers. Therapy caps, high costs (i.e., deductibles, copayments, travel costs, etc.), loss of income and complex charity care applications were the most prevalent themes discussed as being frequent financial barriers to accessing outpatient rehabilitative care. Non-financial barriers included issues related to the client-therapist relationship, transportation, scheduling, and characteristics of the patient and caregiver.

### **Discussion**

In this presentation, we will discuss access to outpatient therapy as a critical piece of the recovery continuum. We will share our initial findings and the resulting implications for clinical practice, including potential solutions to working with clients facing access barriers. We will explore next steps for clinicians, including ways to address both financial and non-financial barriers as well as facilitators to accessing outpatient therapy.

Shakeia Burgin & Anna Zembo

Advisor: Linda Watson

*A Systematic Literature Review of the Impact of Self-Regulation Intervention Strategies on Social Communication Outcomes*

**Research Question**

What were the effects on social communication outcomes of children with ASD who received intervention targeting self-regulation compared to those who did not?

**Background**

Social communication is a key area of deficit associated with Autism Spectrum Disorder (ASD), and social communication abilities are closely aligned with social outcomes such as appropriate social interaction and formation of social bonds for individuals on the spectrum. Emotional regulation and self-management of social behaviors are core capacities underpinning social communication skills (Prizant & Wetherby, 1990). These skills can be characterized by the intrinsic and extrinsic ability to modulate emotion and monitor behavior in various social environments. For the purposes of the present review these skills are referred to as self-regulation or emotional regulation. Individuals with ASD who experience emotional regulation difficulties may also experience negative impact on development of social communication skills. Therefore, interventions that target emotional and self-regulation may have a unique advantage in addressing social communication outcomes in individuals with ASD. To our knowledge, systematic reviews investigating the relationship of social communication and emotional regulation have focused primarily on measuring emotional regulation in individuals with ASD.

**Methods**

A comprehensive search of PubMed, PsychInfo, CINAHL, Cochrane Library, and ComDisDom was conducted using the search terms (1) ASD or autism or Autism Spectrum disorder or Pervasive developmental disorder or Aspergers, (2) self-regulation or emotion regulation or attention regulation or sensory regulation or sensory processing, (3) therapy or treatment or program or management or intervention. These searches found 283 articles, and 5 were eligible for review after abstract and full text reviews were conducted for relevance to social communication outcomes. Studies were excluded if the intervention did not primarily focus on self-regulation and/or if results did not report on social communication outcomes. Each article was appraised for evidence quality using a form. Data extraction focused on the self-regulation intervention targets (i.e. emotion regulation, self-management of behavior) and the reported change on participant social communication behaviors and skills.

**Anticipated Results**

Results of the current systematic review revealed considerable variation in published reports on intervention strategies targeting emotional regulation in individuals with ASD that track social communication outcomes. The articles appraised in this review vary in terms of study design, sample size, and methods utilized to address target self-regulation and social communication skills. The current review included four case series studies and one randomized control trial. Preliminary results suggest positive social communication outcomes for participants engaged in intervention programs targeting emotional regulation and self-management of behaviors. Appraisal of intervention details, specific outcomes and quality of included studies will be further discussed.

**Discussion**

The suggested relationship between emotional/self-regulation skills and social communication may have important implications for goal development and intervention strategies employed in support social communication development in individuals with ASD.

Megan Frey

Faculty mentor: Nancy McKenna

*Factors Affecting Successful Adoption of Connectivity Devices by Hearing Aid Users*

### **Purpose or Research Questions**

- To investigate factors that affect the choice to purchase the HACD and the successful adoption of the device.
- To evaluate patients' views regarding use, benefit, and satisfaction with connectivity devices.

### **Background**

Hearing aid connectivity devices (HACD) are widely marketed to both consumers and professionals in the field of Audiology as devices that can be used to improve communication. However, studies have shown that sales and acceptance of assistive devices is variable (Cranmer, 1991). Becoming informed about device capabilities, and properly learning - and retaining - such information can be difficult for older adults (Hartley, 2010). While major manufacturers advertise multiple capabilities for such devices, there is limited literature regarding patients' perceived benefit of the devices, and whether patients' needs are met (Lesner, 2003).

### **Methods**

Adult patients who had purchased a connectivity device within the past 5 years (from 5 major manufacturers), excluding patients with known cognitive impairment, were considered for the study. All participants had followed the UNC Hearing and Communication Center (UNC-HCC) fitting protocol for HACDs. Subjects were contacted via telephone or in person in conjunction with a previously scheduled appointment. Once the subjects had given consent to participate, they verbally answered survey questions related to the HACDs. Surveys were completed by 30 (15 male, 15 female) out of 95 possible participants. The study was approved by the UNC Office of Human Research Ethics and was not funded.

### **Results**

- No age effect was found in the study cohort: some older users use the device as frequently as younger users.
- Outside recommendations for the device and personal research may be indicators of HACD success.
- Subjects who reported using their HACDs 7 out of the last 7 days were more likely to use their device in a variety of ways compared to subjects who reported less than 7 days/week use.
- Common complaints/reasons for limited use included: not liking the HACD design, poor quality of connectivity, and lack of benefit.
- Overall, subjects, even those who use HACDs daily, were critical of aspects of their devices.

### **Discussion**

Additional scheduled support after the initial fitting may be essential for some users.

- Identification of possible predictors of successful use of HACDs such as: personal research before device purchase, spousal support, comfort with technology, may improve fitting success.
- The rise of tech savvy older adults, and increase in direct Bluetooth capability, may alter HACD fitting in the near future.

Michael Smith & Matthew Suderman  
*A Summary of Peer-Reviewed Psychometric Evaluations of Assessments for Post-Stroke Aphasia*

Faculty mentors: Watson & Steinbrenner

### **Purpose**

The purpose of this systematic review is to summarize the amount of peer-reviewed quantitative information about the psychometric properties of assessments for aphasia.

### **Background**

When assessing people for aphasia, clinicians have many instruments from which to choose. The majority of the manuals for these tools are not peer-reviewed, calling into question the trustworthiness of psychometric properties reported. Efforts have been made to describe the psychometric concurrence of different tools, but description of the quantity of peer-reviewed information available has yet to be published (Skenes et al., 1985). When choosing an assessment, varying clinical situations demand different psychometric profiles. In the case of a long-term rehab patient, high intra-rater and test-retest reliability are paramount whereas acute-stage assessment requires high validity to ensure an accurate diagnosis.

### **Methods**

The authors used the following search terms: aphasia, diagnostic, evaluat\*, assess\*, test, tool, instrument, scale, battery, schedule, reliability, validity, psychometrics. The authors sought diagnostic or descriptive studies in which quantitative psychometric properties were established. The authors excluded screenings, assessments for apraxia of speech, and studies using participants with primary progressive aphasia. Psychometric evaluations of single items from assessments and non-binary comparisons (e.g., studies in which a psychometric property was measured across multiple assessments) were excluded. Tests and articles were excluded if their original language of publication was not English. The authors completed the study exclusion task for all articles obtained and resolved differences by consensus, resulting in 84 articles. Full-text review then was completed using consensus for differences, resulting in 14 articles for review. Appraisal was completed for the 14 articles by both authors using consensus for differences, and data extraction was performed by the authors simultaneously. In data extraction, the authors included only quantitative measures of reliability and validity.

### **Results**

Study appraisal resulted in overall ratings ranging from lesser to good quality. No psychometric properties were reported by more than one study for any test. Test-retest reliability was the most often reported measure (8/12 assessments), followed by inter-rater reliability (5/12), concurrent validity (5/12), and internal consistency (5/12).

### **Discussion**

While unsurprising, the lack of peer-reviewed, quantitative information available regarding the psychometric properties of assessments for aphasia is problematic. Many of these assessments are performed at multiple stages of post-stroke recovery, requiring high temporal reliability and, in the acute stage, good validity. While this information can be obtained from manuals, the methodology may be questionable since manuals are not peer reviewed. Additionally, comparison of psychometric properties through manuals is not financially possible for speech-language pathologists in most settings. Further evaluation of established, often used aphasia assessments is needed to enable clinicians to choose the most psychometrically appropriate tools for each situation.

Taylor Simonds, Michelle Swanson, and Ian Kim Faculty mentors: Watson, Steinbrenner  
*Impact of Sleep on Speech and Language Outcomes Following Stroke*

### **Research Question**

In adult stroke victims, how does quality of sleep affect stroke recovery with regard to speech and language?

### **Background**

Sleep apnea and other forms of sleep disturbance are common among patients who have suffered from stroke. These indicators of poor sleep may impact stroke recovery outcomes. Past studies have linked poor sleep quality to worse functional outcomes in stroke patients, but few have investigated the direct impact of sleep on speech and language in this population. This relationship may carry clinical implications about the sleep needs of stroke patients who are receiving speech and language therapy during their rehabilitation.

### **Methods**

A systematic review of articles investigating the link between sleep, stroke, and speech and language outcomes was conducted to address the research question at hand. The reviewers searched the PubMed database with a string of terms relevant to sleep, stroke, speech, and language, including a set of motor and cognitive terms which may underlie speech and language function. Based on relevance, articles were included by the three reviewers, first through a triple title and abstract review and second through a triple full text review. Reviewer reliability for the title/abstract and full text reviews were 88% and 84%, respectively. Then, the reviewers double appraised the included articles to determine their evidence level and discussed any appraisal discrepancies to establish consensus. Finally, they extracted relevant data from the articles deemed valid and reliable for use in evidence synthesis.

### **Anticipated Results**

The initial search returned 147 articles, which was reduced to 26 results by title/abstract review and to 19 finalized inclusions by full text review. The reviewers anticipate that results of the articles meeting inclusion criteria will indicate an association between suboptimal quality and amount of sleep with worse motor learning and cognitive outcomes in stroke patients.

### **Discussion**

If the results support an association of sleep quality and/or duration with motor and cognitive function in stroke patients, the reviewers will interpret that as indicating that sleep has an impact on speech and language outcomes post-stroke. Such results would support the prioritization of sleep quality during stroke rehabilitation.



Jordan Jarrett

Faculty mentor: Katarina Haley

*Word Repetition and Continuous Speech Analyses in Primary Progressive Aphasia*

### **Purpose**

The purpose of this study was to differentiate phonetic features of the logopenic (LPA) and nonfluent (PNFA) variants of primary progressive aphasia (PPA). Using both narrative speech samples from the Western Aphasia Bank picnic description task and recordings from a motor speech evaluation (MSE), the investigator analyzed the two PPA variants by calculating phonemic and phonetic distortions and word syllable duration (WSD).

### **Background**

In narrative speech samples, people with PNFA produce a restricted number of words, speech rate, sentence structure, and word-length, leading to shorter speech samples compared to any of the other variants of PPA (Fraser et al 2012). For MSE analysis, people with PNFA typically demonstrate a varied and inconsistent error pattern of both phonemic and phonetic errors (Gorno-Tempini et al. 2011). Phonological errors, though not a mandatory characteristic, are often recorded in the speech of individuals with LPA. When errors in speech samples of people with LPA are analyzed, they are often articulated well, leading to a higher instance of phonemic paraphasia. Those phonological errors are most common in multisyllabic words and occur more in repetition compared to narrative tasks (Petrio et al. 2014).

### **Methods**

In this study, the investigator analyzed speech samples from 25 people with PPA: 10 individuals with PNFA, 10 individuals with LPA, and 5 participants with the semantic variant. The WAB picture description task was analyzed using a narrow phonetic transcription protocol. Calculations were based on the total number of words and number of words with phonemic errors, phonetic errors, and distorted substitutions. The word total was restricted to nouns, adjectives, adverbs, and action verbs. The MSEs were transcribed using the same transcription protocol, and each of the words in the files were listened to 1-5 times. Using the transcriptions, percent segments with distortions was calculated based on diacritic distinction, and phonemic errors (deletions, additions, or substitutions) were indexed as the mean phonemic edit distance per segment and as the phonemic accuracy of the entire word. The WSD was calculated as multisyllabic word duration divided by the number of syllables.

### **Results**

The proportion of segments with distortions was significantly greater in the PNFA group than in the LPA group for both the narrative (9.3% vs 2.7%) and MSE samples (11.1% vs 6.0%), and word syllable duration was significantly longer for the PNFA group as well (375 ms vs 253 ms). The participants with the semantic variant did not differ from those with the logopenic variant on these measures.

### **Discussion**

The combination of high distortion frequency and long average syllable duration in multisyllabic words indicates that apraxia of speech (AOS) was common in the PNFA. We will discuss the performance of individual speakers relative to this group result.

Caroline Traub & Ashley Gyori

Faculty mentor: Linda Watson

*The Effects of Electronic Versus Print Books on the Language Outcomes of Early Readers*

## **Background**

In this increasingly technology-focused world, educators and parents alike raise questions regarding the most effective way to educate children. Emergent literacy skills have been of particular interest among researchers in recent years due to their predictive value in academics. This poster aims to answer the following research question, "Among emerging readers, does the use of electronic or print books yield stronger language outcomes?"

## **Methods**

This systematic review looks at the effects of print books versus electronic books with the aim to answer the question "Among emerging readers, does the use of electronic or print books yield stronger language outcomes?" We considered peer reviewed journal articles, cohort studies, randomized controlled trials, critical reviews, and systematic reviews in the analysis of the research. Eric, Psycinfo, and the Nursing & Allied Health databases were searched, as well as a few hand searched articles that were added. Only studies in English were included and participants were all between 2-12 years old. Studies containing children with primary disorders other than a language disorder were not considered.

## **Results**

Twelve studies met all inclusion criteria and were considered in the final review. Overall, studies looked at language comprehension as a whole and other various language outcomes including: orthographic awareness, vocabulary, and phonological awareness, etc. Of the twelve studies, eleven looked at children of the pre-kindergarten and kindergarten age (4-6 years old). Quality appraisal and data extraction are still in progress; however, this will be completed by the time of the presentation.

## **Discussion**

Preliminary findings showed that overall results varied among studies. Most yielded results that showed no significant difference in print reading versus electronic reading. However, some studies that looked at more specific areas of language (such as reading fluency, word recognition, and print knowledge) favored either print or electronic books. Thus, further research is needed to determine if specific areas of language are better served through print or electronic reading. Further research is also needed to determine if these results are applicable to the older populations.

Michelle Fronzaglia and Lily Radack

Faculty mentors: Steinbrenner, Watson

*A Systematic Review of Music Interventions for Dementia*

## **Purpose**

The purpose of this project is to provide a systematic review on available research on how therapy techniques involving the use of music affect the cognitive or communication outcomes or symptoms of dementia in elderly patients with dementia.

## **Background**

There is limited research on non-pharmacological methods for treating patients with dementia. Alternative treatments to medicine can be financially beneficial and also have the potential to reduce negative side effects of drugs. One potential avenue for behavioral treatment is interventions that incorporate music.

## **Methods/Proposed Methods**

For this systematic review, the researchers searched CINAHL Plus with Full Text, PubMed, and Health Source: Nursing/Academic Edition for any applicable research up to the end of January 2017 with the following search terms: (dementia OR Alzheimer's OR memory loss OR cognitive impairment) AND (therapy OR treatment OR intervention OR strategies OR techniques) AND (music\*) AND (cogniti\* OR communicat\* OR language). The inclusion/exclusion criteria were: exclude studies in which the studied population has coexisting neurological impairments (not dementia), only include studies published in English, and only include studies reporting original data. The cognitive and communication outcomes are defined as those involving memory, executive functioning, and language. The original search resulted in 265 articles. After the two researchers completed a title/abstract review independently, 74 articles remained. The inter-rater reliability was found to be 80% and any disparities were discussed and resolved. Then, the researchers independently completed full text reviews. The reliability was 92.5% and any disparities were discussed and resolved.

## **Results**

A total of 11 articles were reviewed for evidence appraisal after the full text review. Four articles were qualitative studies, five were randomized controlled trials, one was a clinical controlled trial, and one was a cohort-prospective/retrospective study. The researchers determined all to be good quality studies except for two, which were determined to be of lesser quality. The researchers' inter-rater reliability for the quality appraisal was 85.7%, and all disagreements were discussed and resolved. Effects of therapy and interventions involving music on language and cognition aspects of dementia will be reported.

## **Discussion**

Music therapies could be a cost effective, clinically significant way to aid behavioral or emotional outcomes. However, there is varying research on the effects of music on cognitive outcomes for dementia patients. Clinical implications and future directions for research will be discussed.

Kelly Allison, Hollis Elmore, Kelsey Roy                      Faculty mentors: Watson, Steinbrenner  
*A Systematic Review of The Impact of Hearing Aid Use on Depression in Adults*

### **Research Question**

In adults with hearing loss, how does hearing aid use influence depression?

### **Background**

Previous research has shown that hearing loss impacts a person's quality of life and that the use of hearing aids can help to improve their quality of life. For this project, we conducted a systematic review to specifically look at how hearing aid use influences depression in order to determine if the results would have clinical significance for hearing aid recommendations and counseling patients.

### **Methods**

The systematic review was performed by searching the databases Embase, PubMed, and CINAHL for key terms associated with hearing loss and depression. The initial search returned 189 articles. The articles were reviewed based on inclusion and exclusion criteria. Quality appraisals and data extraction are being completed on 8 articles that met inclusion and exclusion criteria.

### **Anticipated Results**

The 8 articles included 3 longitudinal studies, 3 cohort studies, 1 cross sectional study, and 1 randomized control trial. Based on preliminary data, it appears that the use of hearing aids helps to improve the patient's feelings of depression.

### **Discussion**

The results of the systematic review have clinical implications regarding potential benefits of hearing aid use in adults in relation to quality of life.

Karson Moore, Emma Gibbings

Faculty mentor/s: Watson & Steinbrenner

*Influence of Hearing Aids on Speech and Language of Children with Mild Hearing Loss: A Systematic Review*

### **Purpose**

The purpose of this systematic review is to determine the influence of hearing aids on the speech and language outcomes of children with mild hearing loss.

### **Background**

One to six per 1000 children in the United States are born with hearing loss. While many of these children can be identified with Newborn Hearing Screening programs, children with mild degrees of hearing loss are more likely to be missed at these screenings. Mild hearing loss is often diagnosed later in life. Hearing loss can have significant negative effects on the development of speech and language. Hearing aids have been shown to mitigate these effects in children with greater degrees of hearing loss, however, there is less known about the impact hearing aids have on the speech and language development of children with mild hearing loss.

### **Methods**

CINAHL Plus and PubMed were searched by the authors during January 2017, with a supplemental search on Google Scholar. The following keywords were used to create the search: Mild sensorineural hearing loss OR mild hearing impairment OR mild hearing loss, hearing aids OR amplification, children OR pediatric, language OR speech. Studies on unilateral hearing loss, adult populations, greater degrees of hearing loss, and cochlear implants were not included in this review. The authors independently reviewed for inclusion/exclusion, quality appraisal, and data extraction for the systematic review, and used a consensus procedure for any differences.

### **Results/Anticipated Results**

The initial search yielded 109 articles; 30 of these were selected for full text review. Seven articles met the criteria to be included in the systematic review. Included studies assessed the impact of hearing aids on speech and or language development in pediatric populations (birth-18 years) with mild hearing loss (20-45 dB HL). Analysis of the seven articles is still underway. Preliminary findings indicate hearing aids may provide benefit for speech and language development in children with mild hearing loss.

### **Discussion (e.g., interpretation of results; potential contribution of anticipated results)**

Evidence exists that supports the idea that hearing aids provide benefit to the development of speech and language of children with mild hearing loss. Studies have produced variable results; while there is a generally positive impact, more evidence is needed to provide a strong clinical recommendation for the implementation of hearing aids in these children. Future research should be conducted in this area to provide a more complete understanding of the impact of mild hearing loss on speech and language development, as well as how hearing aids influence this developmental process.

Lisa Copeland

Faculty mentors: Jack Roush and Holly Teagle

*Hearing Loss and Comorbidities in Children with Cytomegalovirus (CMV)*

### **Purpose**

The purpose of this study is: 1) to gather information regarding congenital CMV in a population of children who have been treated with cochlear implants, and 2) to describe known comorbidities and disabilities. The study is part of a long-term investigation of speech perception outcomes in this population.

### **Background**

Cytomegalovirus (CMV) is the most common cause of non-genetic congenital hearing loss. Many children exposed to the virus in utero are born with severe to profound hearing loss and others may experience progressive hearing loss throughout childhood. Cochlear implantation is often an effective treatment option, but benefit may be complicated by the presence of comorbidities such as neurologic disorders secondary to brain changes, neuromuscular sequelae, and other conditions including autism. Some children are affected only by hearing loss.

### **Methods**

A retrospective chart review included 77 children with confirmed diagnoses of congenital CMV who received cochlear implants at UNC. Data were gathered under a protocol approved by the UNC Institutional Review Board (IRB). Analyses included the total number of children with a confirmed diagnosis of CMV, degree of hearing loss, and known disabilities or comorbidities.

### **Results**

There were 77 children with a confirmed diagnosis of congenital CMV infection implanted at our center. This may be an underestimate of the number of children affected with CMV due to the low sensitivity of retrospective diagnosis. Thirty-one percent of the children (24 of 77) had one comorbidity and 8% had multiple comorbidities.

### **Discussion**

Children infected with congenital CMV are a diverse population facing many challenges best managed by an interdisciplinary team. Cochlear implantation typically improves access to sound but the development of speech perception abilities may be confounded by the presence of comorbidities and developmental delays. An understanding of the potential speech perception outcomes for children with CMV is useful when counseling families and planning habilitation. Other diagnostic tools such as Magnetic Resonance Imaging (MRI) may indicate the presence of brain changes but currently does not measure the impact of CMV or predict cochlear implant success. Although there is variability in performance with cochlear implants because of the heterogeneous characteristics of this population, cochlear implantation provides access to sound and a foundation for the development of expressive and receptive language skills.

Ginni Lam  
*A Task-Based Assessment of Academic English Pronunciation*

Faculty mentor: Lisa Dombly

### **Purpose or Research Questions**

This poster will outline the process of developing a task-based assessment of academic English pronunciation and will illustrate its components. The author will explain analysis procedures and utility of the assessment for prioritizing aspects of pronunciation and grammar that are relevant to academic English and the individual's professional interests.

### **Background**

Many existing assessment materials for English pronunciation are designed primarily to elicit specific sounds in individual words and sentences. The materials are not typically representative of natural speech production. The goal of most international faculty, students, and visiting scholars is to pronounce English as a "lingua franca" (an international language of communication) in academic environments. The authors developed a task-based assessment of English pronunciation, including a standardized oral paragraph reading, elicited sentences related to the task, and a spontaneous speech sample. The assessment simulates the kinds of tasks learners are required to perform outside of the classroom. The purpose of the task is to quickly assess aspects of pronunciation that have the greatest impact on overall speech intelligibility, along with qualitative dimensions of communication.

### **Methods/Proposed Methods**

The task incorporates vocabulary from the academic word list (Coxhead, 2000), and the academic phrase list (Ellis et al., 2008), and prioritizes elements important for intelligibility among lingua franca speakers and listeners (Szpyra-Kozłowska, 2014). The task-based assessment is constructed with the following components:

1. Oral reading of a paragraph describing the purpose and characteristics of an effective "elevator pitch" (a concise summary of one's work to share in various professional contexts).
2. Oral reading of an example elevator pitch on the topic of emotional intelligence in mentor-mentee relationships.
3. A series of six open-ended Wh-questions designed to stimulate the subject's thinking regarding developing a potential elevator pitch.
4. A spontaneous speech and language sample of 30 to 90 seconds in which the subject delivers an elevator pitch specific to their own academic interests.
5. Self-rating of participation in various communication activities
6. Demographic and background information

### **Results and Discussion**

Combined results of the Task-based Assessment of Academic English Pronunciation facilitate prioritization for pronunciation and grammar that are relevant to academic English and the individual's professional interests. The relative severity rating of each element determines the relative importance for instruction. Following instruction and learning, the task can be re-administered for comparison with the initial results.

Lorraine Osborne, Mariana Valverde, Caitlyn Whitson      Faculty mentor: Linda Watson  
*Cochlear implantation in children under twelve months: A systematic review*

### **Research Question**

How does cochlear implantation in children under 12 months of age affect speech and language outcomes compared to children implanted after 12 months of age?

### **Background**

Cochlear implantation is indicated for children with significant hearing loss who demonstrate limited benefit from a conventional hearing aid trial. Although the FDA only permits implantation in children 12 months of age or older, off-label implantation has occurred in children under 12 months of age. While some studies do not find statistically significant results due to small sample sizes (Miyamoto et al., 2008), others offer support for implantation in the population in question by demonstrating significant speech and language benefit as compared to children implanted over 12 months of age (Dettman et al., 2016). The aim of the present systematic review is to assess the efficacy of cochlear implantation in children under 12 months of age with regard to speech and language outcomes.

### **Methods**

We conducted a search of the following databases: CINAHL, PubMed and PsychInfo. The search was limited to articles published between 1990-2017. Our search retrieved 128 articles of which 45 were from CINAHL, 57 from PubMed, and 26 from PsychInfo. Articles were accepted into the initial pool if the participants included infants implanted before 12 months of age who received follow-up evaluations assessing receptive and/or expressive language. Upon title and abstract review, 86 studies were eliminated. Forty-two studies were included for full-text review. Of those 42 articles, 27 were eliminated due to lack of control comparison group, lack of participants under 12 months of age, and/or lack of speech/language outcome follow-up. The articles were evaluated by two independent reviewers. Interrater reliability was calculated to be 96% while performing title and abstract review.

### **Anticipated Results**

This systematic review included 15 articles, including systematic reviews, retrospective cohort studies, and longitudinal cohort intervention studies. Quality appraisals of the included articles and data extraction are in progress at this time.

### **Discussion**

Although this systematic review is not yet complete, the potential contribution of the anticipated results above is evident. Current evidence is mostly composed of retrospective cohort studies, and the included studies suggest evidence that supports cochlear implantation before 12 months of age.



Kelly Allison, Skye Dorsett, Marisa Marsteller, Melissa Simpson

Faculty mentors: Baker, Grose, Fort, Roush

*Outpatient Re-screening of Newborn Infants Using ABR and OAE*

**Purpose:**

The purpose of this presentation is to share a retrospective analysis of outpatient rescreening practices currently employed in North Carolina using auditory brainstem responses (ABR) and otoacoustic emissions (OAE) and to share the preliminary results of an ongoing prospective investigation using a combined protocol including both OAE and ABR for outpatient rescreening in a tertiary care medical center.

**Background:**

Newborn hearing screening has become a standard of care throughout the United States. Protocols vary, however, for follow-up with infants who do not pass the initial screening. At UNC Hospitals and at most birthing hospitals in North Carolina, newborns undergo initial hearing screening prior to discharge. If the infant refers in either ear the family is scheduled to return for outpatient rescreening. Although several studies have compared automated auditory brainstem response (AABR) screening to otoacoustic emissions (OAE) screening in the well-baby nursery, the two technologies have not been compared at the time of outpatient rescreening

**Methods:**

Outpatient rescreening for both AABR and OAE are performed using the Intelligent Hearing Systems SmartScreener-Plus2. Variables include test time, cost of consumables, and rescreening outcomes. North Carolina's EHDI database, *HearingLink*, was used to examine inpatient and outpatient screening practices and outcomes at 81 birthing hospitals over a one year period from 10/1/15 to 9/30/16.

**Results/Discussion:**

Preliminary findings, consistent with studies conducted during the birth admission, suggest that AABR screening takes longer than OAE and requires more expensive consumables, but results in a higher pass rate. Challenges include OAE probe fit, adhesion of the AABR ear coupler, and delays associated with the infant's sleep state. Rescreening outcomes for infants using AABR and OAE will be discussed including the costs and benefits of achieving a higher pass rate at the time of initial screening.

Rebecca Sukhu and Kendra Thomas

Faculty mentors: Watson and Steinbrenner

*Best Practice in Feeding for Children with Pierre Robin Sequence*

## **Purpose**

The purpose of this presentation is to investigate the feeding outcomes of mandibular distraction compared to tongue to lip adhesion in infants with Pierre Robin Sequence

## **Background**

Pierre Robin Sequence (PRS) is a congenital disorder characterized by retrognathia/micrognathia, glossoptosis, and respiratory distress and may result in a cleft palate. These craniofacial abnormalities cause significant difficulties with feeding and breathing during infancy and childhood. Though surgical intervention is a potential solution for this population, it can only be performed after a certain level of physical development has occurred, often referred to as the Rule of 10s. Children with PRS have difficulty getting the proper nutrition to optimize growth, especially in combination with breathing difficulties, which can result in failure to thrive. It is clinically important to determine the best practices for managing patients affected by craniofacial anomalies and swallowing disorders, including children with PRS who have a complex array of symptoms that impact feeding.

## **Methods**

The researchers used key terms relating to the disorder and population of choice to search across different databases focused on health science. Next, the researchers completed independent title and abstract reviews in order to exclude unrelated articles. After the title and abstract reviews, researchers performed full text and quality reviews of the remaining studies in order to finalize the data for evaluation.

## **Results**

The studies being evaluated have employed the use of mandibular distractors and tongue to lip adhesion techniques in order to improve respiration and feeding. In some instances, these interventions were ineffective and tube feeding was necessary to provide sufficient nourishment. A majority of the studies examined were conducted on smaller sample groups, due to the rarity of this condition in the general population. Quality appraisals and data extraction are in the process of being completed. Thus far, we have found that while these interventions provide adequate relief of respiratory distress in order to allow for oral feeding. Further data analysis is currently underway to determine if mandibular distraction or tongue to lip adhesion strategies provide the best outcomes for oral feeding and address feeding difficulties on a holistic level.

## **Discussion**

Our anticipated results are based on multiple research studies with rather small sample groups. A majority of these studies were conducted using fewer than 50 participants, due to medical complexity of PRS and the relative rarity of studies, which look at patients with isolated PRS not occurring in conjunction with another syndrome and were conducted largely in hospitals with easy access to participants. These small, non-random samples may have skewed research findings in the direction of success for distractors, as they are most commonly used.

Sam Lebold, Morgan McGowan, Kalie Mitchell                      Faculty mentors: Steinbrenner, Watson  
*Does Kangaroo Mother Care have an impact on breastfeeding or oral feeding readiness measures in preterm infants? A systematic review.*

### **Research Question**

In preterm infants, how does Kangaroo Mother Care, or skin-to-skin contact, influence breastfeeding or oral feeding readiness?

### **Background**

Kangaroo Mother Care (KMC) was first established in Bogotá, Columbia by Doctors Rey and Martinez (Rey & Martinez, 1983). In KMC positioning, an infant wearing only a diaper and hat, when appropriate, is placed in between the mothers' breasts in an upright position, creating skin-to-skin contact (SSC) between the mother and infant. Rey and Martinez (1983) promote early implementation of KMC in a continuous and prolonged manner where possible.

KMC has been proven to be a cost-effective alternative to traditional incubation, and is easy to administer (Broughton et al., 2013; Sharma et al., 2016). There is also research to support the efficacy of KMC for many outcomes, including reduction in risk of mortality, infection, and sepsis in preterm infants (Conde-Agudelo, 2016). KMC has also been shown to significantly improve thermoregulation abilities and shorten hospital stays (Charpak et al., 1997). There is an increasing body of research on feeding measures regarding KMC's impact on feeding readiness in preterm infants. We conducted our study in order to gain a comprehensive view of the literature pertaining to this topic.

### **Methods**

A systematic search was performed on three databases: PubMed, CINAHL, and ProQuest. Researchers did not time-limit the search. The following search terms were used: skin to skin, kangaroo care, kangaroo mother care, SSC, preterm, premature, infant, baby, babies, neonate, breastfeeding, and oral feeding. Studies were included if the population consisted of preterm infants, KMC or SSC was the primary intervention, breastfeeding or oral feeding was a primary or major secondary outcome, and if the studies were experimental, original in nature, and published in a peer-reviewed journal. The abstracts of the articles were reviewed, and articles were excluded if they were not in English or were case studies or non-experimental. Of the 616 articles identified in the search, 13 articles met the full inclusion criteria and were included in the review.

### **Anticipated Results**

The systematic review consists of 7 randomized control trials, 1 cross-sectional study, 3 longitudinal studies, and 2 cohort studies. Quality appraisal and data extraction are in progress.

### **Discussion**

KMC cannot be proven to be beneficial, but is assuredly not harmful for preterm infants. Furthermore, the fact that KMC is cost effective, easy to implement, and has other positive outcomes suggests it could be a good intervention to use for preterm infants that are medically stable, particularly those in more rural or under-sourced areas. Future research should adhere to more consistent definitions of KMC, breastfeeding outcomes, preterm infants, and any other primary outcomes or measures in order to make a more confident claim about the efficacy of KMC as an intervention for feeding outcomes.

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*Language Outcomes in Bilingual Individuals with Dementia: A Systematic Review*

**Faculty mentors:** Dr. Linda Watson, Dr. Jessica Dykstra Steinbrenner, Michaela DuBay

### **Research Question**

In people with dementia, how does being bilingual influence the manifestation of dementia related to language skills?

### **Background**

Language loss is a paramount component of dementia, and in the case of bilingual speakers, declines in language functioning can occur predominantly in the first language (L1) or in all languages spoken. However, the literature is mixed with regard to whether the two languages decline in tandem or differentially (i.e., one language declines more than the other(s); Nanchen et. al, 2016; Ivanova et. al, 2014; Stilwell et. al, 2016). Thus, the present study reviewed the literature in order to (1) determine the nature of the loss in one or more languages in bi- or multilingual individuals with dementia, and (2) to describe the characteristics of that decline with regard to various language domains, including verbal fluency, code-switching, and pragmatic usage, among others.

### **Methods**

Researchers utilized six databases to electronically search for articles that met inclusion criteria in February 2017. The initial searches yielded 227 articles after deduplication. The researchers utilized the following inclusion criteria: (1) bilingual or multilingual adult participants, diagnosed with any form of probable dementia; (2) studies including language outcomes (L1/L2 and dominant/non-dominant); (3) studies published in English; (4) study designs comprised of randomized control trials, cohort studies, case studies, systematic reviews, cross-sectional studies, case-control studies, non-randomized control trials, and meta-analyses. Researchers first independently completed title and abstract reviews yielding 61 articles to move to the next round for full-text reviews. Researchers then independently completed full text reviews yielding 15 articles for final inclusion.

### **Anticipated Results**

Fifteen studies were included to explore the language outcomes of bilingual and multilingual adults diagnosed with probable dementia of any form. A large majority of studies (n=9), concluded parallel deterioration of all languages spoken by participants. From the included studies, we noted multiple factors reported by the researchers accounting for the parallel or nonparallel deterioration of languages: (1) age of acquisition, (2) proficiency or dominance, (3) and frequency of use. Language declines in each language were also reported to vary longitudinally.

### **Discussion**

A review of the literature yielded a complex and, at times, inconclusive picture of the language outcomes in bilingual individuals with dementia. Studies reported contradicting findings as to whether languages declined simultaneously or asynchronously (Salvatierra et. al, 2007; Kowoll et. al, 2015). Our preliminary findings were consistent with the conclusions of a similar systematic review completed by Stilwell et. al in 2016, regarding language outcomes more specifically in patients with probable Alzheimer's disease, a form of dementia. Further research into the language outcomes of bilingual and multilingual adults with dementia will allow for a better understanding of the progression of their language decline due to neurodegenerative disease.