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# 2018 Student Research Day

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Friday April 27  
1:00-5:00 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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# Tenth Annual Division of Speech and Hearing Sciences Student Research Day

Friday April 27, 2018  
1:00 – 5:00pm  
University of North Carolina – Chapel Hill  
Kirkland Auditorium and West Lobby

## Welcoming Remarks

Dr. Sharon Williams 1:00 – 1:10

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

1. Meg Dillon 1:10 – 1:25  
*Accuracy and Acclimatization of Low-Frequency Pitch Perception in Cochlear Implant Recipients with Normal Hearing in the Contralateral Ear*
2. Ranita Anderson 1:25 – 1:40  
*Exploring considerations and barriers for early intervention services for children at-risk for ASD*
3. Sofia Benson-Goldberg 1:40 – 1:55  
*Children with CDKL5: Visual Attention to Print During Shared Reading Before and After Print Referencing*
4. Jennifer Stone 1:55 – 2:10  
*ROaR Together: Pediatric Health Providers Implementing Reach Out and Read*

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

1. Jenni Shafer 2:10 – 2:30  
*“Leading the Charge:” Caregivers navigating rehabilitative care access and the recovery journey for people with aphasia after stroke*
2. Jonet Artis 2:30 – 2:50  
*Is there a relationship between early parent concerns and a later developmental disorder diagnosis?*
3. Kathryn Dorney 2:50 – 3:10  
*Impact of Core Vocabulary, Attribution, and Aided Language on Communication Skills of Preschool Students with Autism Spectrum Disorder*

**Poster Session 1 (11 posters)**

3:10 – 4:00

1. Megan Brown and Cassie Doster  
*Assessment of Autism Spectrum Disorder in Children who are Deaf or Hard of Hearing*
2. Christine South, Grace Padget, Makayla Anderson  
*Systematic review of parenting interaction style and communication outcomes in children with Autism Spectrum Disorder*
3. Ashton Harris  
*Ipsilateral Masking Effects on Hearing Thresholds in Adults*
4. Kasey Bethancourt, Amanda Monaco, & Sandra Rumswinkel  
*Effects of Literacy Intervention on Children with Autism Spectrum Disorder*
5. Stefanie Brodowski and Sallie Elliott  
*The impact of joint reading intervention on language development in children: A systematic review*
6. Danielle Campion, Sophie Bowen, Marie Payne  
*Social Communication Outcomes in Children and Adolescents with Traumatic Brain Injury: A Systematic Review*
7. Kathryn Sobon  
*Contralateral masking effects in children and adults*
8. Amy Hill and Juliana Powell  
*Feeding Intervention Outcomes for Infants with Cleft Lip/Palate and Their Families: A Systematic Review*
9. Margaret Richter  
*Review of Daily Cochlear Implant Use on Initial Speech Perception*
10. Meredith Towey, Emily Fender, Kiarra Hill  
*The Relation Between Cognitive Reserve, Functionality, and Post- Mortem Cortical Structures in Adults with Alzheimer's Disease*
11. Jordan Bellucci, Stephanie Griffin  
*Prevalence of Vestibular Dysfunction in Children with a Congenital CMV Infection or Connexin 26 Variance: A Systematic Review*

**Poster Session 2 (12 posters)**

4:10 – 5:00

1. Jordan Jarrett, Taylor Petroski, Marissa Rock  
*Life Participation Outcomes in Group versus Individual Therapy for Adults with Aphasia: A Systematic Review*
2. Kaylene King, Jenna Sawafta, Analee Haas  
*A Systematic Review of Early Cochlear Implantation Outcomes (Under 12 Months)*
3. Betsy Gorman, Kathryn Distefano  
*Distortion Frequency and Syllable Location after Left Hemisphere Stroke*
4. Addison Francis, Alexandra Hay  
*Biofeedback Techniques in the Treatment of Dysphagia*
5. Jenna Hall  
*Errors in Nonwords vs. Real Words after Left Hemisphere Stroke*
6. Kaylene King  
*The Effect of Low-Frequency Acoustic Cues on Speech Perception in Noise for EAS Recipients*
7. Michael Smith & Katarina Haley  
*Phonetic Complexity and Speech Sound Errors in Aphasia and Apraxia of Speech*
8. Lorraine Smith and Cameron Coppala  
*Disfluencies in Autism Spectrum Disorder (ASD)*
9. Daniel Picetti, Sarah Smith, Melissa Smith  
*Expressive and Social Language Outcomes of Adults With Developmental Disabilities Who Use Augmentative and Alternative Communication Systems: A Systematic Review*
10. Tayler Simonds  
*Expressive Communication Skills of Patients with Angelman Syndrome*
11. Arielle Abrams, Ashleigh Starnes, Stephanie Noble  
*Audiological Considerations for Individuals with Cerebral Palsy, Deafblindness and Autism Spectrum Disorder*
12. Danielle Mitton and Candace Neufville  
*Efficacy of Work-Based Hearing Conservation Programs: A Systematic Review*

Margaret Dillon, AuD

Faculty mentor: Emily Buss, PhD

*Accuracy and Acclimatization of Low-Frequency Pitch Perception in Cochlear Implant Recipients with Normal Hearing in the Contralateral Ear*

**Purpose:** The aims of the present report are to assess 1) the accuracy of pitch perception in cochlear implant (CI) recipients, 2) the acclimatization of pitch perception during the first year of device use, and 3) the association between pitch perception, participant variables (electrode array insertion depth), and device variables (coding strategy).

**Background:** Low-frequency pitch perception may contribute to the outcomes of CI recipients, including speech recognition in quiet and noise. Multiple variables may influence the pitch perception of CI recipients, including neural survival, position of the electrode array, duration of device use, and coding strategy. Pitch perception tasks typically involve the participant comparing the pitch through the CI to the pitch of an acoustic target presented to the contralateral ear. Conventional CI recipients present with moderate-to-profound hearing loss in the contralateral ear, and the accuracy of pitch perception is likely to be impaired in both the CI and hearing-impaired ear. Recently, CI use has been investigated in participants with moderate-to-profound sensorineural hearing loss in one ear and normal to near-normal hearing in the contralateral ear (NH-ear), known as unilateral hearing loss (UHL). Cochlear implant recipients with UHL offer an opportunity to more accurately assess pitch perception since the comparison stimulus is presented to a normal-hearing ear.

**Methods:** Participants (n=19) completed a prospective, repeated-measures pitch-matching task during their first year of CI use. Participants were recruited from a cohort who underwent cochlear implantation as part of a clinical trial investigating CI use in cases of UHL. As part of the clinical trial, participants listened with a coding strategy that presents fine structure cues on the four most apical electrodes. The pitch-matching task was a 2-alternative forced-choice comparison, where the participant compared the pitch of apical electrodes to an acoustic target (pure tones and click-trains) presented to the NH-ear. Participants completed the pitch-matching task at 1, 3, 6, and 12-months after CI activation. At the 12-month interval, a subset of subjects completed the pitch-matching task while listening with an envelope-only coding strategy to assess the influence of fine structure cues on low-frequency pitch perception.

**Results:** The pitch match associated with apical electrodes was similar whether the comparison stimulus was pure tones or click-trains. There was no interaction between electrode and test interval, indicating the low-frequency pitch-match did not change over the study period. The pitch-match was generally in line with frequency-to-place functions, which like reflects a close correspondence between CI filter frequencies and electrode position. There was a significant difference between the pitch-match associated with the most apical electrode when participants were presented with fine structure cues as compared to envelope-only cues.

**Discussion:** Participants with UHL offer the opportunity to assess the accuracy and acclimatization of pitch perception with a CI. The present cohort demonstrated a short acclimatization period. Pitch perception in the preset cohort may have been influenced by the electrode array insertion depth and coding strategy, which may have offered a match between place coding and rate coding.

### **Research Questions**

- Do differences exist in the quantity/types of services received by at-risk infants/toddlers later diagnosed with ASD versus those with non-ASD outcomes?
- Do race and/or socioeconomic status predict early intervention (EI) access?
- Does developmental status or ASD symptom severity predict EI access?
- What are factors described by parents that influence pursuit of services and/or create barriers for pursuing or accessing services?

### **Background**

It has been long reported that EI supports better outcomes for children with ASD. Even with this knowledge, children are often not diagnosed with ASD until they age out of birth to three services. This often means the services a child may receive do not target specific ASD behaviors with the intensity that is recommended for children with ASD. Additionally, existing literature does not address how, why, and who pursues or accesses EI services in the context of a positive ASD screening. We do know that many factors play a role in accessing services for older children with ASD and other diagnoses. These factors include demographic variables such as SES, race and parental education as well as parent and child factors such as the severity of the child's challenges. Barriers also have been noted in attempts to obtain EI services. Some of these barriers include waiting times, awareness of services and scheduling.

### **Proposed Methods**

We will apply a mixed methods approach to analyzing extant data from the Early Development Project – 2. We will start with analyzing differences in EI services for children later diagnosed with ASD versus those with non-ASD outcomes. A t-test will be used to determine mean differences in services accessed between the two groups. To examine factors that predict services accessed, we will use developmental measures from the Mullen Scales of Early Learning and autism symptom severity from the Autism Observation Scale for Infant as well as demographics related to SES and race as predictors of amount of services accessed and the time lag prior to the initiation of any services, employing multiple regression analysis. The qualitative portion of this study will include use of the General Inductive Approach (GIA) using summary of interviews from two different follow-up time points. We will explore connections relating to pursuit of EI services. This will allow us to develop a framework and determine themes related to parents' experiences with EI, including barriers and reasons they pursued or did not pursue services. These themes will then be compared to the quantitative information to determine how and if they support those findings.

### **Anticipated Results**

It is expected that children with lower developmental scores and more severe autism symptoms will receive more services, and that children from lower SES backgrounds will receive fewer services. Considerations related to access to services may align with findings from previous studies of older children with ASD in noting difficulties with scheduling or family priorities.

### **Discussion**

Results of this study will help us better understand who is accessing services, give some insight into why services are accessed and barriers to accessing these services. We will also determine if differences exist in the quantity of services families based on whether or not an ASD diagnosis is given in the preschool age. This will provide foundational knowledge regarding whether having autism-like symptoms gives rise to appropriate EI.

Oral presentations

Sofia Benson-Goldberg

Faculty mentor: Karen Erickson, PhD.

*Children with CDKL5: Visual Attention to Print During Shared Reading Before and After Print Referencing*

**Purpose:** This study will examine the patterns of visual attention to print that occur during shared reading for young children with CDKL5, and asks whether the use of print referencing strategies increases visual attention to print. The research questions, designed, planned procedures and potential implications for emergent literacy interventions will be shared.

**Background:** Emergent literacy is broadly defined as the reading and writing skills that precede conventional literacy (Teale & Sulzby, 1986), including understandings of the functions and conventions of print (Senechal, LeFevre, Smith-Chant, & Colton, 2001). Shared reading is a research-based intervention that supports the emergent literacy skills of students with and without disabilities (NELP, 2008). Print referencing is a strategy used to increase a child's understanding of concepts and conventions of print (Justice & Ezell, 2004). Pairing print referencing with shared book reading allows children to improve both their oral language skills and their written language concepts (Justice & Ezell, 2002). Historically, children with developmental disabilities have had substantially different experience with and access to literacy when compared with their typically developing peers (Koppenhaver, Coleman, Kalman & Yoder, 1991; Light & Smith, 1993). Physical, sensory and/or cognitive impairments lead to reduced opportunity to develop and integrate emergent literacy skills as a result of reduced access to materials for reading, writing and communicating. Children with CDKL5 have a combination of motor, cognitive, sensory and communication impairments that significantly impact their ability to interact and learn. The combination of impairments makes it challenging to assess cognitive and communication skills among children with CDKL5, but new eye-gaze technologies offer a means of passively recording and analyzing these skills.

**Proposed Methods:** A preliminary, descriptive study will be conducted with three parent-child dyads in their homes. Participants will include three children aged 36 to 96 months with CDKL5 and one of their parents. Eye-gaze technology, digital children's books, and a computer configured with software for observing and recording interactions will be used. During baseline, each dyad will read six electronic books selected from a bookshelf created for this study. At the conclusion of baseline, parents will be taught a print referencing approach described by Justice et al. (2008). This parent-focused intervention will be mediated over Skype, and modified for the individual needs of each parent-child dyad. Three dependent variables drawn from Justice and Lankford (2002) will be computed: (1) entrance into a print zone: the child's eye-gaze enters a print zone; (2) fixation in a print zone: the child's eye-gaze fixates (50 ms or longer) in a print zone (a fixation represents the processing of information according to Rayner, 1985); and (3) time in a print zone: the total amount of time the child's eye-gaze spends in a print zone, encompassing both saccades and fixations. Descriptive statistics will be computed for all variables, and dependent variables will be compared across unfamiliar and familiar reading conditions using a series of repeated measures ANOVAs.

**Anticipated Results:** After the print-referencing intervention, it is expected that the parents will increase their print referencing during shared reading. Subsequently, it is expected that the children will increase their attention to print. Further exploration will be needed to examine how the interaction between the parents and their children impacts the children's visual attention during shared reading.

**Discussion:** These results have the potential to begin to build the literature about how parents might use shared book reading and print referencing to increase print awareness for their children with CDKL5 while continuing to reap the benefits of shared reading.

Oral presentations

Jennifer Stone

Faculty mentor/s: Dr. Karen Erickson

*ROaR Together: Pediatric Health Providers Implementing Reach Out and Read*

### **Purpose**

The purpose of this study is to understand how providers and clinic staff at Duke Children's Primary Care perceive, implement and feel about the evidence-based pediatric literacy program, Reach Out and Read. The long-term goal is to help the clinic maximize the effectiveness of the program.

### **Background**

Reach Out and Read impacts nearly 5 million American children annually. Its aim is to set each child up for a lifetime of success by providing parents with books and information about the importance of daily shared reading at every well-child visit from the time a child is six months to five years of age. Reach Out and Read is a non-profit that was established 27 years ago. It currently has 5,800 program sites and distributes 6.9 million books per year. Duke Children's Primary Care is one of those sites. As an evidence-based practice, Reach Out and Read aims to ensure that all children have the chance to thrive at the most optimal level modern research, medicine, and engaged community can provide. Previous research regarding implementation of Reach Out and Read demonstrates the importance of clinic culture in maximizing implementation efficacy. In this project, I propose to engage with clinic staff at Duke Children's Primary Care through semi-structured interviews to investigate their current Reach Out and Read program and practices, identify areas of strength and need, and identify clinic-specific potential next steps to improve implementation efficacy and ensure that every child has the opportunities provided by growing up surrounded by books, words, and caregivers who value both.

### **Proposed Methods**

Each of twenty subjects will engage in a 30-minute semi-structured interview regarding personal experiences, impressions, suggestions and feeling about participation in Reach Out and Read. Interviews will be transcribed and coded. Themes will be extracted and communicated with Duke Children's Primary Care to identify the most efficacious next steps in program improvement and expansion.

### **Anticipated Results**

Enthusiastic participation by a representative sample of providers and staff is anticipated. Interview results are expected to provide previously unforeseen insight regarding existing barriers and potential creative quality improvement strategies to insure full efficacy and implementation of the Reach Out and Read program.

### **Discussion**

Evidence gathered from the current study will be shared with a nationwide audience of practitioners to facilitate increased efficacy of implementation and impact program-wide.

Jonet Artis

Faculty mentor: Dr. 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 diagnosis? Question 3: Are there differences associated with race (i.e., Black/African American vs. White) in the likeliness, types, and number of concerns expressed by parents when children?

### **Background**

Some parents of children later diagnosed with autism or other DD 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. Another factor that may impact the likeliness of parents to report a concern is race/ethnicity. 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, we investigated if parents of different races differ in their expression of concerns in ways that may account for variability in the diagnostic history.

### **Methods**

We used the open-ended questions from the First Year Inventory (FYI)(Reznick et al., 2007) and the Developmental Concerns Questionnaire (DCQ)(Reznick et al., 2005). The FYI was completed by parents of children aged 12 months of age and the DCQ was completed by parents for the same children at 24 months of age. Using extant data from approximately 650 parents, we compared the responses of parents of children diagnosed with a disorder by age 3 years (n=43) and parents whose children were not diagnosed with a disorder. We conducted chi-squared analyses to determine if there were any group differences in likeliness to report a concern and asymptotic linear-by-linear associations test to determine if there were any differences in the total number of concerns reported. The analyses were completed for both 12 and 24 months. We used a subset of FYIs to analyze responses to the two open-ended questions about parental concerns for Black and White families. We compared the two groups based on likeliness of any concern, types of concerns, and average number of concerns.

### **Results**

Preliminary analyses revealed that there were significant differences in the likeliness of parents to report a concern at 12 months and 24 months and the number of concerns reported when comparing parents who had children later diagnosed with a disorder to parents who did not have children later diagnosed with a disorder ( $p$ -value < 0.01). There were no significant differences in the likeliness to report a concern and number of concerns reported when comparing White parents to Black parents at 12 and 24 months. We noted no striking differences in types of concerns expressed by Black versus White parents; however, we lacked a sufficient sample of Black parents to make statistical comparisons within the different types of concerns parents expressed

### **Discussion**

Findings about the timing and nature of parent expressions of developmental reinforce the conclusions of prior researchers that combining surveillance with standardized developmental screening tools is a more optimal approach to early identification of children who may benefit from early intervention.

Oral presentations

Jennifer S. Shafer, Paul R. Shafer, and Katarina L. Haley Faculty mentor/s: Katarina Haley  
*“Leading the Charge”: Caregivers navigating rehabilitative care access and the recovery journey for people with aphasia after stroke*

## **Purpose**

The purpose of this study was to examine what roles caregivers for people with aphasia take on, particularly in terms of facilitating access to outpatient rehabilitation care and navigating the recovery journey, and what might cause them to assume these roles.

## **Background**

Up to 40% of stroke survivors acquire aphasia and require long-term caregiver assistance after discharge from the hospital. Caregivers assume multiple roles as they help people with aphasia to access outpatient rehabilitative care in an increasingly person-centered model of care. Yet, caregivers are frequently provided little training, education and support regarding how to navigate outpatient care and what to expect in terms of the recovery journey.

## **Methods**

Thirty-six people participated in the study, including seven caregivers, 22 stroke survivors with aphasia, and seven healthcare providers. Participants with aphasia and caregivers comprised four of the five focus groups (group 1 n=7, group 2 n=7, group 3 n =10, group 4 n =5), and one focus group consisted of rehabilitation professionals and hospital administrators from a patient and family advisory board (n=7). An iterative qualitative analysis was used to identify themes.

## **Results**

Results indicate that caregivers assume numerous roles apart from simply facilitating access to outpatient rehabilitation for people with aphasia. They adopt diverse roles as advocates, therapists, motivators, and protectors. Caregivers assume these roles in order to fill in gaps in services or to otherwise facilitate the recovery journey for the person with aphasia.

## **Discussion**

Caregivers adopt diverse roles during the recovery journey. Assuming these roles helps facilitate rehabilitation for the person with aphasia. Feedback from each stakeholder in the recovery journey—the person with aphasia, the caregiver, and the healthcare provider—provides a comprehensive picture of the roles caregivers adopt and why they opt to do so. Our findings reiterate the importance of including caregivers in the rehabilitation process. Providing caregivers with the training and support they need throughout the recovery journey by treating them as partners in the process may mitigate caregivers’ urge to adopt these multiple roles.

Oral presentations

Kathryn Dorney, MA.CCC.SLP

Faculty Mentor: Karen Erickson, PhD

*Impact of Core Vocabulary, Attribution, and Aided Language on Communication Skills of Preschool Students with Autism Spectrum Disorder*

**Purpose:** This presentation will describe changes in communication of 13 preverbal preschool students with autism spectrum disorder (ASD) from the initial implementation of a core-vocabulary communication intervention focused on teaching symbolic communication. Sources of data include field notes that reflect changes in educators' method of instruction and students' responses and student level of communication as measured by the Communication Matrix (Rowland, 2004; 2011).

**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. At the onset of the study, Picture Exchange Communication System (PECS) was the sole AAC system available to the children who are participants in this study. This investigation examined how the educators integrated the use of core vocabulary with PECS to create a robust AAC system in classrooms with preschool students with the educational classification of ASD. 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). This study fills an important gap in the AAC literature, as research regarding the use of core vocabulary with students with ASD is limited.

**Methods:** A mixed-method design was used to systematically compare Communication Matrix assessments of 13 preschool students with ASD pre-and post-intervention and analyze 30 sets of field notes. Inductive coding was used to analyze the field notes for instances of transactional language learning and use. Constant-comparative analysis (Glasser & Strauss, 1992) was used to seek commonalities in themes concepts.

**Results:** Educators implemented the use of aided language input differently in each classroom. However, all educators were observed to use aided language input similarly during instructional routines. Themes include: (a) individual access to individual access to students' AAC systems, (b) students' use of pre-symbolic and symbolic communication, and (c) aided language modeling use by educators. Results of pre-and post-intervention assessments reveal students' use of symbolic communication for requesting increased with educators modeling. Changes in symbolic communication use with students using graphic symbols communication for refusing, social, and information were also noted.

**Discussion:** This study has the potential to inform the use of aided language input with core vocabulary as a means of targeting symbolic communication by special educators in self-contained special education preschool classrooms. Furthermore, the findings have implications for helping students who currently communicate requests using PECS to begin using core to expand their communication to a broader range of communication functions.

**Disclosure:** I am a paid research assistant on the grant from the U.S. Department of Education that funded this work.

Megan Brown and Cassie Doster

Faculty mentors: Steinbrenner & Page

*Assessment of Autism Spectrum Disorder in Children who are Deaf or Hard of Hearing*

### **Research Question**

This systematic review aims to answer the following question: In children who are deaf or hard of hearing (D/HH), what are the strategies and challenges for accurate assessment of Autism Spectrum Disorder (ASD)?

### **Background**

ASD has a higher occurrence in the D/HH population than in the total population. According to Roush & Wilson 2014, 1.7% of children who are D/HH have ASD, which is higher than the national prevalence of 1 in 68 (Mood & Shield 2014). Additionally, diagnosis of ASD often occurs later in children who are D/HH than in children with normal hearing, with an average age of formal diagnosis not until 6 years 4 months (Szarkowski, et al 2014). Some report common confusion over diagnosis because of overlapping symptoms, such as not responding to one's name and delayed language acquisition; however, early diagnosis of ASD is important for positive outcomes later on. This study aims to examine why these challenges occur and what can be done to help this population.

### **Methods**

A comprehensive literature search was conducted using the CINAHL and PsychInfo databases using the following search strategy: ("hearing loss" OR "hard of hearing" OR "hearing impair\*" OR deaf\* OR Deaf) AND (ASD OR auti\* OR Auti\* OR Asperger\* or PDD\* OR "Pervasive Developmental Disorder") AND (assess\* OR strateg\* OR eval\* OR screen\*), yielding 202 results. A title and abstract screen resulted in 20 articles which were further reviewed under inclusion and exclusion criteria, resulting in 10 articles for final review. Quality appraisals were conducted for each article by two independent reviewers using Cincinnati Children's LEGEND tools. For each step, inter-rater reliability was required to be at least 90%. Data was then extracted and synthesized to look for challenges and strategies regarding ASD assessment.

### **Results**

Of the ten studies included in the review, five were found to be good quality, four to be lesser quality, and one not applicable for quality due to its qualitative design. The review found several overarching themes in the challenges of both screening and evaluating ASD in children who are D/HH: 1) some well-known red flags for ASD are common in typically-developing children who are D/HH; 2) assessments for ASD are not designed for this population; 3) providers are not trained to work with both ASD and deafness; and 4) for those who use ASL, you cannot simply translate common assessments into ASL. Analysis is not yet complete regarding strategies for accurate assessment, but it is anticipated that the literature will agree upon a need to train clinicians to work with both ASD and deafness and to know symptoms that are characteristic of children with both disabilities.

### **Discussion**

Children with ASD who are D/HH in general are diagnosed later than those with typical hearing. Many professionals are not knowledgeable about both populations, and therefore feel uncomfortable to give a diagnosis. There is a need to train more professionals to work in both fields and to create tools suitable for assessing ASD in the D/HH population, so that these children can receive a diagnosis and services at a younger age for more optimal outcomes.

Christine South, Grace Padget, Makayla Anderson      Faculty mentors: Steinbrenner and Page  
*Systematic review of parenting interaction style and communication outcomes in children with Autism Spectrum Disorder*

### **Research Question**

In young children with autism spectrum disorder, how is parenting interaction style (responsiveness vs directiveness) related to concurrent and later communication outcomes?

### **Background**

Research has suggested a link between responsive parenting styles and better language outcomes for children. For children with autism spectrum disorder (ASD), language and social skills are a primary concern that is best addressed earlier rather than later. For this reason, early, parent-mediated interventions for children with ASD have become a focal point of research while the link itself between responsive parenting and greater language outcomes is still being verified.

### **Methods**

A systematic search of studies investigating parent interaction and communication in young children with ASD was carried out using predefined search strings in PubMed, PsychINFO, and ERIC. Included were peer-reviewed intervention and description articles published between 1990 and January 2018 that studied young children with diagnosed or at risk for ASD and no co-morbid conditions. Initially, the team found 155 articles were identified and following deduplication, 132 articles remained. At least 20% of articles at each step were double reviewed. Interrater reliability was above 80% at all steps of review.

### **Results**

There were 32 articles following title and abstract reviews, and after full-text review, 21 articles were eligible for quality appraisal. After using the Joanna Briggs Institute quality appraisal tools, 14 of the 21 articles passed our inclusion criteria (Briggs, 2017). The researchers focused data extraction on the 8 of the 14 articles that were intervention studies to maximize possibility for clinical implications. Most of the intervention studies reported at least some positive impact on language outcomes for children with ASD associated with increasing parental responsiveness (Shire et al.; Baranek et al.; Brian et al.; Haebig et al.) Several of the longitudinal and case studies showed a link between a responsive style of parenting and greater language abilities in the children (McDuffie, A & Yoder, P.) However, some studies showed that intervention that targets parental communication may be more successful for children with lower levels of language initially (Carter et al.; Haebig et al.)

### **Discussion**

Evidence shows preliminary support for targeting parent responsiveness to mediate communication in toddlers with ASD. While the results were overall positive, indicating that interventions focused on increasing responsive parent communication led to better language outcomes for children with ASD, there was some evidence that the interventions were more effective with children who had initially lower levels of communication. There also was a tapering effect of many of the treatments from exit to follow-up. Further quality research needs to be done to investigate the most effective intervention approach, the sub-population of children with ASD for which this might be most beneficial, and the long-term impacts on language overall following parent-mediated intervention.

Ashton Harris  
*Ipsilateral Masking Effects on Hearing Thresholds in Adults*

Faculty mentor: Dr. Emily Buss

### Research Questions

The purpose of this research study was to answer the following questions:

- 1) How can audiologists develop a clinical test for patients with hearing loss?
- 2) What is effect of masker level and masker type on word recognition in normal-hearing listeners?

### Background

Ipsilateral masking can be defined as masking that is presented in the same ear as the target word. Clinicians can utilize ipsilateral masking in order to assess the effectiveness of a hearing aid or cochlear implant for listening in a noisy environment. Within ipsilateral masking, this research study examined the thresholds of hearing with informational and energetic masking. Informational masking occurs when a participant cannot focus on the target word because several words or conversations are being presented simultaneously. Typically, children are more susceptible to informational masking. On the other hand, energetic masking occurs when a participant is unable to hear the target word due peripheral response to the noise swamping out response to the target.

### Methods

I tested six undergraduate students using the program entitled ChEgSS\_Exp2A\_UNC\_v2d on MatLab. Before beginning the program, I ensured that my participants had normal hearing by performing a tympanogram and hearing screening with extended high frequency headphones in a soundproof booth. Participants kept the high frequency headphones on and were instructed to select the image on an iPad of the word that they hear. We then estimated the threshold signal level associated with 71% correct word recognition. The two-talker masker tested for the effect of informational masking while the speech shape noise masker tested for the effect of energetic masking. The six conditions as follows were presented in a random order and the threshold values were recorded:

1) SSN Masker; 75 dB SPL	2) SSN Masker; 60 dB SPL	3) SSN Masker; 45 dB SPL	4) Two Talker Masker; 75 dB SPL	5) Two Talker Masker; 60 dB SPL	6) Two Talker Masker; 45 dB SPL
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### Results

I anticipated that the participants would have a lower threshold in two-talker masker since adults are typically less prone to informational masking in comparison to children. In my results, the majority of participants were able to hear the target word at a lower level in the three two-talker masker conditions. However, one participant got higher thresholds in the two-talker masker conditions in comparison to the speech shape noise masker.

### Discussion

The results of my research study indicated that participants are likely to have a higher threshold in either energetic or informational masking, but not both. There is a trend for thresholds to increase with increasing level in the noise masker (2 dB), and for better performance at 60 dB SPL than 45 or 75 dB SPL in the speech masker (3 dB). More data are needed to confirm these trends. These results will be useful to audiologists working with patients that have hearing loss. Audiologists can use these results as a reference for normal hearing in order to analyze how informational and energetic masking influences the threshold values for patients with hearing loss.

Kasey Bethancourt, Amanda Monaco, & Sandra Rumswinkel

Faculty mentors: Steinbrenner & Page

*Effects of Literacy Intervention on Children with Autism Spectrum Disorder*

### **Research Question**

In school-aged children with autism, what is the impact of literacy interventions with embedded reading comprehension strategies on literacy and language outcomes?

### **Background**

Autism Spectrum Disorder (ASD) is a complex developmental disability characterized by impairments in social interactions and communication. Since it is a wide spectrum of varying strengths and abilities, quantifying and teaching literacy or language goals deviates from their typically developing peers. The authors of this systematic review were interested in exploring how elementary (K-5) children with ASD learn these literacy and language goals differently, and which interventions are successful in reducing the gap between this population and their peers in respect to these goals.

### **Methods**

This study is a systematic review of the current research on literacy interventions with children with Autism Spectrum Disorder. The researchers began with 5 databases: PubMed, ERIC, CINAHL Plus, Education Full Text, and Psych Info. The search terms used in the data bases were: autism (ASD, autistic, autism spectrum disorder, Asperger's) and literacy interventions (literacy, reading comprehension, reading skills, reading tests). The researchers used the following for inclusion criteria: peer reviewed, articles in English, autism, literacy interventions, school aged participants, and school aged (K-5). The exclusion criteria was: articles not in English, non-peer reviewed, articles with adult participants, meta-analyses/systematic reviews.

### **Results**

The results yielded a wide variety of intervention types: the search produced 750 articles. Following de-duplication 454 articles remained. After reviewing the titles and abstracts of the 454 articles, the researchers continued with 73 articles to complete the full text review. The researchers kept 17 articles after the full-text review and eventually concluded with 9 articles for data extraction following the quality appraisal. Many utilized visual supports like a graphic organizer or story mapping to answer reading comprehension questions. In one study, researchers read along with the student in a storybook; this method did not show significant progress in the students' comprehension of the text. Other studies utilized direct instruction to implement techniques to improve reading fluency as well as comprehension. Overall, the interventions yielded improvement in literacy and language outcomes. The reviewers organized the results based on the target dependent variables of the interventions into the broad categories of comprehension and literacy.

### **Discussion**

Just as autism is a spectrum, so are the different types of literacy interventions. In this study we found a wide array of techniques and strategies that showed significant improvements in literacy and language outcomes— making it difficult to clinically recommend specific interventions for children with ASD. We did not expect a singular “gold-standard” intervention since children with ASD are impacted so differently, but the broad results of this study were surprising. It is recommended that future systematic reviews examine a specific intervention within literacy for children with ASD.

Stefanie Brodowski and Sallie Elliott

Faculty mentors: Steinbrenner & Page

*The impact of joint reading intervention on language development in children: A systematic review*

### **Research Question**

What is the impact of joint reading intervention on language development in children age 6 and below with pre-existing language delays or disorders?

### **Background**

Book reading is known to promote early language and literacy skills for young children, including vocabulary enhancement, increased mean length of utterance, and enriched phonological awareness. Joint book reading has been observed to emphasize a more interactive experience for the parent-child dyad, encouraging the child to engage in the text, answer questions, and develop further communication skills. A previous meta-analysis of literature on this topic was conducted (Mol, 2008), focusing on the vocabulary development of children who engaged in joint reading versus those who received standard reading experiences. Considering that vocabulary development is a small piece of overall language development, this systematic review was conducted in order to uncover the additional impacts of joint reading on language development of young children.

### **Methods**

Three databases were used to identify published peer-reviewed articles for this systematic review: ERIC, Education Full Text, and PsycInfo. Initial search terms included terminology such as “joint reading,” “dialogic reading” and “language delay”. Main exclusion criteria consisted of: participants with diagnoses other than language impairment, participants who are bilingual or dual-language-learners, and studies conducted outside of the United States. All articles were reviewed and appraised by each reviewer and met the reliability standard of 80%.

### **Results**

Each study included measured various pre-literacy skills such as overall engagement, verbal participations, or number and type of words used. The initial search resulted in a total of 69 but after applying the exclusion criteria and further full text reviews were completed, a total of 7 articles remained for quality appraisals. Results from the various studies indicated that children who participated in joint reading produced more relevant language; they increased the length of each utterance and included more new words. However, joint reading did not significantly impact other skills that were observed such as increased phonological awareness and the ability to initiate a story or conversation. Overall results showed that unless the skill was specifically targeted by the parent through joint reading activities the skills did not improve.

### **Discussion**

These studies were able to highlight the benefits that joint reading has on developing language skills in children with pre-existing language delays. While joint reading may not help improve every aspect of language development, there are specific modifications that can be used in order to address specific language skills. Further research needs to be conducted in order to examine the long-term effects that joint reading has on language development.

Danielle Champion, Sophie Bowen, Marie Payne Faculty mentors: Steinbrenner & Page  
*Social Communication Outcomes in Children and Adolescents with Traumatic Brain Injury: A Systematic Review*

### **Research Question**

What are the characteristics of social communication in children and adolescents with Traumatic Brain Injury (TBI)?

### **Background**

There is a large amount of research on the cognitive communication impacts of traumatic brain injury in children and adolescents. However, the impact of TBI on social communication in this population has been less explored. The aim of this systematic review was to synthesize and understand the existing research on TBI in children and adolescents surrounding the impacts of social communication.

### **Methods**

The authors conducted a systematic review of peer reviewed journal articles in the following databases: PubMed, PsycInfo, and CINAHL. The search terms included: *Traumatic Brain Injury, TBI, concussion, social skills, social language, pragmatics, pragmatic, social cognition, social awareness, social communication, child, children, toddlers, infants, adolescents, youth, toddler, infant, and adolescent*. The inclusion criteria included children and adolescents (0-21), mild, moderate, and severe TBI, concussion, English speaking participants, studies with and without control populations, retrospective, and prospective studies. The exclusion criteria included adults with injury during childhood, children with autism, developmental disabilities, hearing loss, congenital brain malformations, strokes and studies about theory of mind/ problem-solving skills. Authors initially completed a title abstract review of 197 articles leading to 46 full-text reviewed articles. Nine articles were appraised for quality. Articles were appraised individually using the *Cincinnati Children's Legend: Evidence Appraisal of a Single Study All Domains Descriptive Study, Epidemiologic Study, Case Series*.

### **Results**

Of the nine articles appraised for quality, data extraction was completed on six. These studies used in the systematic review yielded different results based upon different research questions all surrounding social communication in children and adolescents with TBI. Social communication encompasses many different aspects (ie: social participation, outcomes, etc.) which are portrayed through the articles in this systematic review. All six articles used for data extraction were determined to be of high quality. The synthesis of these studies suggests that younger age at injury and injury severity lead to significant impacts on social communication.

### **Discussion**

Initially, the authors expected there would be more focused outcomes on social communication in the pediatric TBI population. There is no standardized assessment tool that measures social communication in children with TBI. Many of the articles stated this as a limitation. There is also a necessity for more longitudinal and follow-up studies in order to understand the long-term/ overall impacts of TBI on social communication in children and adolescents. While there is a need for future research and more clearly stated outcomes of social communication in children and adolescents with TBI, the results of this systematic review are clinically significant due to indications that there is a correlation between social communication deficits and traumatic brain injury in this population.

Kathryn Sobon  
*Contralateral masking effects in children and adults*

Faculty mentors: Dr. Buss and Dr. Grose

### **Research Questions**

This project set out to answer three questions:

1. How does masked speech perception differ for children compared to adults when the masker is presented contralateral to the target?
2. Does contralateral masking differ for a two-talker vs. speech-shaped noise masker?
3. Does contralateral masking differ for 45 dB SPL and 75 dB SPL masker levels?

### **Background**

The ability to segregate speech sounds or “parse the auditory scene” is important for listening in noise. The “cocktail party effect” occurs when the brain needs to selectively attend to only one auditory signal while ignoring the others. We know that children have a greater difficulty than adults with this task. It is also supposed that testing speech perception with a two-talker masker is more reflective of the everyday experience of listening in noise.

### **Methods**

A. Listeners: Ten adults (19.3-35.2 years) and 10 children (5.9-10.7 years) served as participants. All participants were screened for normal hearing and middle ear status.

B. Stimuli: Stimuli included 30 disyllabic easily illustrated words within the vocabulary of a typical five-year-old. Maskers were either two-talker speech or speech-shaped noise. The two-talker masker was composed of two female speakers reading selections of *Jack and the Beanstalk*, and the speech-shaped noise was spectrally matched to the two-talker masker.

C. Conditions: Target words were always presented to the left ear. Performance was measured in four contralateral masker conditions: two masker types (two-talker speech and speech-shaped noise) x two levels (45 or 75 dB SPL). In the control condition, target words were presented in quiet in the left ear.

D. Procedure: Listeners sat in a sound-treated room with an iPad. They were instructed to select the picture corresponding with the target word they heard using the iPad touchscreen. Participants chose from four pictures presented on the screen. An adaptive threshold procedure estimated the signal-to-noise ratio associated with 71% correct performance in each condition.

### **Results**

All subjects had higher thresholds (more difficulty) in the two-talker masker compared to the speech-shaped noise masker. All participants had higher thresholds (more difficulty) in the low intensity conditions (45 dB SPL) as opposed to the high intensity conditions (75 dB SPL). Children performed worse than adults in every condition.

### **Discussion**

Using a two-talker masker in clinical situations is more representative of the kinds of listening challenges that children and adults experience in everyday life. By using the typical speech-shaped noise masker in clinical settings, clinicians are not getting the most accurate reflection of an individual’s hearing abilities. In terms of the overall age effect, it is more difficult for children to segregate the auditory scene and focus on one stream of information. It is not until early adulthood that this skill develops to be “adult-like.”

Amy Hill and Juliana Powell

Faculty mentors: Steinbrenner & Page

*Feeding Intervention Outcomes for Infants with Cleft Lip/Palate and Their Families: A Systematic Review*

### **Purpose**

This systematic review is intended to investigate the progress of the research addressing feeding interventions for the isolated cleft lip/palate infant population since the most recent Cochrane Review available through the ASHA Evidence Maps, which drew conclusions from five high quality randomized control trial studies (Bessell, 2011). We will review a broader scope of the literature published after 2010 by including other study designs of varying quality. Therefore, our systematic review intends to address the following research question: In infants with isolated cleft lip/palate or cleft palate only, what is the impact of feeding interventions on child and family outcomes?

### **Background**

Infants with cleft lip and palate (CLP) often require an adaptive feeding method because the majority do not feed well at the breast. The feeding mechanics among this population also differ, especially in regard to the sufficiency of intraoral suction (Gallagher et al., 2017).

### **Methods**

We conducted a systematic review of the literature between January 1, 2010 and January 31, 2018. We searched the PubMed and ProQuest Psychology databases using an extensive list of search terms and their synonyms. The inclusion criteria were English text only, infant/child, isolated/non-syndromic cleft palate, and any feeding intervention. The exclusion criteria were Pierre Robin, micrognathia, syndromic cleft palate, and non-peer reviewed. Twenty percent of the titles and abstracts were double-reviewed with blinding with 98% agreement on inclusion/exclusion, and 100% agreement after a consensus discussion. All of the articles for full-text review were blind double-reviewed with 100% agreement. The research team conducted quality appraisals using the Joanna Briggs Institute quality appraisal tools, and extracted relevant data from the articles that remained following the quality appraisals.

### **Results**

424 articles were brought in after deduplication, which were narrowed down to 43 following our title and abstract reviews. We then eliminated case studies, case series, and systematic reviews, and any others that did not meet inclusion criteria after a brief review. This resulted in 19 remaining articles. After completing thorough full-text reviews on these articles, 10 articles remained: six retrospective cross-sectional studies, two randomized control trials, a prospective cohort study, and one prevalence study. Using the quality appraisal tool, we determined that five of the articles are low/lesser quality, and only 50% are high quality articles.

### **Discussion**

Based on our results, infants with CLP only have more feeding difficulties than infants with only cleft lip (Kaye et al., 2017). The type of cleft has a greater effect on weight gain than the type of bottle used to feed the infant (Martin & White, 2014). We also identified parent education, increase in volume of intake, concentration of caloric density, and placement of a nasogastric feeding tube as common feeding interventions (Britton, McDonald, & Welbury, 2011; de Vries et al., 2014; Hubbard, Baker & Muzaffar, 2012; Kaye et al., 2017; Zarate et al., 2010). These interventions may lead to better growth, and improved likelihood of infants with cleft palate being fed breast milk (Alperovich et al., 2017; Zarate et al., 2010) or possibly a combination of breast milk and formula (Ize-Iyamu & Saheeb, 2011). We also noted that the preferred method of feeding by mothers is dependent on their location and healthcare system.

Margaret Richter

Faculty mentors: Margaret Dillon and Meredith Rooth

*Review of Daily Cochlear Implant Use on Initial Speech Perception*

**Purpose**

The primary objective of this ongoing study is to review whether daily device use influences speech perception within the initial months of listening experience. This report reviews the preliminary speech perception and subjective benefit data.

**Background**

Cochlear implant (CI) recipients are counseled that daily device use during waking hours is needed to acclimate to the sound quality of the CI and improve speech perception. However, while there is research that shows speech perception is improved with device use over time<sup>1</sup>, there is limited evidence to suggest that the number of hours the device is worn daily is indicative of early speech perception performance. The clinical CI programming software recently began providing information on the hours of daily device use between programming sessions, called datalogging. The present report reviews the potential association between hours of daily device use and speech perception. A variable of consideration in this analysis is the role of auditory environment. Potentially, CI recipients who are in more dynamic listening environments may experience a faster rate of speech perception improvement.

**Methods**

Subjects are followed in conjunction with their routine CI follow-up intervals (initial activation, 1, 3 and 6 months). At each interval, subjects complete a questionnaire regarding their listening environments. The speech perception test battery includes word recognition in quiet and sentence recognition in quiet and noise. Datalogging information are obtained from the clinical report.

**Results**

Nine subjects have enrolled and are participating in the study protocol. Preliminary review indicates the majority of subject (n=8) listen with their CI between 10-15 hours a day (mean: 12 hours). The improvement in speech perception with the CI at the 1-month interval was not correlated with duration of daily device use, however, this could be due to the limited variability. Subjective report demonstrated some subjects listened with their CI for fewer hours per day than their HA, while others reported improvements in subjective benefit after 1-month of device use.

**Discussion**

Overall, subjects in this initial cohort followed the clinical recommendation of at least 8-10 hours of use per day in the first month. We hypothesize that different outcomes may result from limited daily device use; however, our subjects so far have been generally compliant. Enrollment and data collection are ongoing.

Meredith Towey, Emily Fender, Kiarra Hill

Faculty mentors: Steinbrenner & Page

*The Relation Between Cognitive Reserve, Functionality, and Post-Mortem Cortical Structures in Adults with Alzheimer's Disease*

### **Research Question**

How does cognitive reserve influence the relation between reported functionality and atrophy in the brain of adults with Alzheimer's Disease?

### **Background**

It is believed that certain life experiences, such as education, social interaction, or cognitively stimulating activities, may contribute to building cognitive reserve. Cognitive reserve may delay a clinical diagnosis of Alzheimer's because it may postpone the onset of symptoms even in the face of physical pathology. Identifying which life experiences have the most impact on building cognitive reserve could help postpone the onset of Alzheimer's disease for future generations and increase the number of quality years individuals may have.

### **Methods/Proposed Methods**

To complete this systematic review, the researchers searched five databases (Proquest, PsychInfo, Ageline, Academic Search Premier, CINAHL) using the following key search terms: "Cognitive Reserve", "Alzheimer's" and "Postmortem". Articles were chosen after a title/abstract review using the following inclusion criteria: (1) lifestyle elements of cognitive reserve, (2) quantitative analysis of functionality, (3) post mortem brain analysis, (4) original research in English peer-reviewed journal. Researchers were 90% reliable for inclusion status after double reviewing 25% of the total articles. A second title/abstract review was completed using the following exclusion criteria: (1) failed to mention pre-mortem levels of cognitive functions, (2) failed to include post-mortem brain scans (3) participants were not adults with Alzheimer's. Next the researchers conducted a full-text review of the remaining articles using the above inclusion and exclusion criteria while double reviewing 83%. Any discrepancies in inclusion status at this stage were resolved via group collaboration. Quality appraisals were conducted using "LEGEND: Evidence Appraisal of a Single Study Descriptive Study, Epidemiologic Study, Case Series" (Cincinnati Children's Hospital, 2012). Researchers were 100% reliable on quality ratings.

### **Results/Anticipated Results**

Three-hundred and three articles were yielded and reduced to 4 after title/abstract and full text review. Three of the articles were judged to be good quality descriptive/epidemiological studies. One article was judged to be a lesser quality descriptive/epidemiological study. The research showed that cognitively stimulating activities throughout the lifespan and large social networks help build cognitive reserve (Bennett et al., 2006; Reed et al., 2011).

### **Discussion**

After review and data extraction, the researchers have concluded that a greater number of quality studies should be completed to make the connection between cognitive reserve, brain atrophy, and the physical manifestation of Alzheimer's Disease. Methods of measuring cognitive function were inconsistent throughout the research with some using the Mini Mental State Examination (MMSE) and others using composite scores from multiple cognitive tests. Therefore, a "gold standard" method of quantifying cognitive function in longitudinal studies of Alzheimer's disease should be found. Also, more diverse populations, inclusive of race and education, should be studied to create better generalizability.

Jordan Bellucci, Stephanie Griffin

Faculty mentors: Steinbrenner & Page

*Prevalence of Vestibular Dysfunction in Children with a Congenital CMV Infection or Connexin 26 Variance: A Systematic Review*

### **Research Question**

What is the estimated prevalence of vestibular dysfunction in children with congenital hearing loss related to a CMV infection or Connexin 26 variance, using vestibular-evoked myogenic potential (VEMP) testing?

### **Background**

Vestibular dysfunction is well documented and studied in the general adult population, yet there is less research examining the prevalence in the pediatric population. Vestibular dysfunction can be caused by multiple factors including genetic causes and viral/bacterial infections. Two of the most common causes of hearing loss in the pediatric population are due to the viral infection, Cytomegalovirus (CMV), and variation in the gene that codes for Connexin 26 proteins, or GJB2 (Maes et al., 2017). Through the use of a systematic review, we were interested in determining if there is a prevalence of vestibular dysfunction present in children with CMV and Connexin 26. We focused on studies using vestibular-evoked myogenic potential (VEMP) testing, which has been found to be an effective tool for measuring vestibular function in children (Inoue et al., 2013).

### **Methods**

A systematic review was performed to analyze and compare vestibular dysfunction for two of the most common causes of hearing loss in the pediatric population, CMV and Connexin 26 variance. A literature search for articles in peer-reviewed journals was completed using CINAHL, PubMed, and Scopus databases with the search strategy [(Vestibular) AND (CMV OR Cytomegalovirus OR GJB2 or Connexin 26)]. All articles were independently assessed by the authors throughout the article selection, quality appraisal, and data extraction process. Reliability of the search strategy was measured based on article agreement between authors.

### **Results**

The initial search yielded 258 articles, with 29 articles selected for full-text reviews. A total of 8 articles met all criteria and were determined to be eligible for data extraction and analysis. VEMP testing between the two populations showed a general trend of more vestibular dysfunction present in the CMV group compared to the Connexin 26 variance group. This dysfunction includes both unilateral and bilateral dysfunction. Additionally, the degree of vestibular dysfunction for children with symptomatic CMV was more severe compared to those with non-symptomatic CMV. Studies that evaluated gross motor performance also showed children with CMV were more likely to have developmental delays compared to their peers with Connexin 26 variation.

### **Discussion**

The increased prevalence of vestibular dysfunction found in children with CMV has implications for overall gross motor function and performance, which can impact developmental milestones. This supports the need for vestibular testing in children diagnosed with CMV. However, the prevalence of vestibular dysfunction in these studies varied greatly. There is a continued need for further research investigating the prevalence of vestibular dysfunction in the pediatric population.

Jordan Jarrett, Taylor Petroski, Marissa Rock      Faculty Mentors: Steinbrenner & Page  
*Life Participation Outcomes in Group versus Individual Therapy for Adults with Aphasia: A Systematic Review*

### **Research Question**

In individuals with aphasia as a result of a stroke, how does participation in group therapy compared to individual therapy influence life participation?

### **Background**

When evaluating the status of individuals post-stroke, their extracurricular participation in activities is often underreported (Skolarus, Burke, Brown, & Freedman, 2014). Within speech-language pathology, there has been a push for usage of the World Health Organization's International Classification of Functioning, Disability and Health (ICF) framework (Galletta & Barrett, 2014). The ICF focuses on functional communication goals, activity participations, and limitations (Papathanasiou & Coppens, 2016). Therefore, targeting the restrictions that individuals are feeling in social settings should be an aspect of intervention. Therapy models, specifically individual versus group therapy sessions, are important to consider as therapists seek to include more opportunities for functional communication. This systematic review set out to explore this idea by analyzing available evidence on life participation outcomes in individual versus group therapy for individuals with aphasia following a stroke.

### **Methods**

The authors used three databases: ComDisDome, CINAHL Plus, and PubMed. Inclusion criteria required that 1) studies had to address individual, group, or both therapy models for individuals with aphasia, 2) participants had to have a diagnosis of aphasia, and 3) inclusion of an outcome measure related to life participation. The authors completed Title/Abstract and Full Text reviews using criteria. Title/Abstract reliability (90%) and Full Text Review reliability (85%) was determined for 20% of the articles. Quality Appraisal Review reliability (100%) was determined for 40% of the articles. Data extraction reliability (100%) was determined for 40% of the articles.

### **Results**

The search generated 171 articles. A subset of ten articles met criteria (three case studies, two cross-sectionals, two randomized control trials (RCTs), one cohort study, one measure review, and one controlled clinical trial). Articles ranged from good to lesser quality. The two RCTs showed group therapy is beneficial for life participation. The non-RCT studies supported group therapy for individuals with aphasia; however, comparisons were not made to individual therapy in these studies. Our conclusion is that group therapy improves life participation equally or more than individual therapy.

### **Discussion**

In order to answer our research question, further high-quality research is needed to determine life participation results via direct comparison of these therapy models. Given the multitude of ways to phrase "life participation" and "group therapy," additional search terms might be necessary to encompass more research related to our initial question.

Kaylene King, Jenna Sawafta, Analee Haas

Faculty Mentors: Steinbrenner & Page

*A Systematic Review of Early Cochlear Implantation Outcomes (Under 12 Months)*

### **Purpose**

This systematic review aims to look at the current research assessing the outcomes of children who receive a cochlear implant before 12 months of age compared to the outcomes of those implanted after 12 months of age and their age-matched normal hearing peers.

### **Background**

Due to the standardization of universal newborn hearing screenings in the United States and several other countries, children with severe to profound sensorineural hearing loss are being identified earlier, leading to more immediate intervention. The Joint Committee on Infant Hearing's 2007 position statement stated the goals for pediatric hearing loss intervention as: identification by one month of age, diagnosis by three months of age, and intervention by six months of age (JCIH, 2007). Currently, children with severe to profound hearing loss undergo a several month hearing aid trial prior to proceeding with a cochlear implant evaluation, and the current FDA guidelines only allow pediatric cochlear implantation at 12 months of age and beyond (McKinney, 2017). However, as technology and surgical techniques continue to improve, there is a push to alter the FDA guidelines to allow implantation prior to one year of age. In order to assist with this movement, there must be strong evidence in the literature that illustrates significant benefits that outweigh the potential risks of early implantation.

### **Methods**

A literature search was conducted in three databases (PubMed, CINAHL, and ComDisDom) to identify articles assessing the outcomes of children implanted before 12 months of age with the following inclusion and exclusion criteria: children with no comorbidities, articles published within the last fifteen years, and an age at implantation range for the comparison groups of 12 months to 18 years, with a preference for research with children implanted under 10 years of age. Studies were evaluated for quality using the Joanna Briggs Institute Critical Appraisal tools (JBI, 1996). The inter-rater reliability between reviewers was assessed upon title-abstract review, full-text review, quality appraisal, and data extraction with each reviewer being blinded to which articles were being evaluated for reliability and the decision of the second reviewer to either include or exclude each article.

### **Results**

After completing the review and quality appraisal processes, data extraction was completed on nine studies of various designs. Overall, these studies suggest that earlier cochlear implantation for children under 12 months of age yields benefits in speech perception, language acquisition outcomes, and other aspects of development when compared to children implanted beyond 12 months of age. Furthermore, several studies found that the development of speech and language in children implanted before 12 months of age was comparable to their age-matched normal hearing peers.

### **Discussion**

The current research on the outcomes of children implanted before 12 months of age suggests significant benefits to multiple aspects of development when compared to those implanted later, with some studies showing comparable outcomes to their normal hearing peers. While this research is promising, the majority of these studies were case series and cohort designs. Moving forward, more high-quality research should be conducted on this topic in order to fully examine the possible benefits and implications of implanting children before 12 months of age.

Betsy Gorman, Kathryn Distefano

Faculty Mentor: Katarina Haley

*Distortion Frequency and Syllable Location after Left Hemisphere Stroke*

### **Research Questions**

Which distortions are most common in patients with aphasia resulting from left hemisphere stroke? Which syllable location (onset, nucleus, coda) is most frequently affected by distortions?

### **Background**

Perceptually salient speech sound production errors are common in aphasia (Blumstein 1973) and they can be classified and analyzed in a variety of ways. Errors classified as “substitutions” give the perceptual impression that the speaker has selected or accessed incorrect phonemes and articulated these normally. In contrast, errors classified as “distortions” imply that the correct phoneme was accessed, but articulated in an imprecise or unusual way (Cunningham, Haley, and Jacks 2016). There is debate about whether consistency of error location and type should be included in the diagnostic criteria for apraxia of speech (AOS) (Bislick et al. 2017). Some studies have found that consonant and vowel imprecision are diverse and variable in AOS (Blumstein, Cooper, Zurif, & Caramazza 1977; Haley 2004) but there is evidence that errors are more consistent at syllable level than word level (Haley, Cunningham, Eaton, & Jacks 2017).

### **Methods**

After taking an introductory clinical phonetics course, the authors were further trained in narrow phonetic transcription using Klattese, a variation of phonetic transcription that incorporates computer-readable symbols, and Praat, a software for phonetic analysis. Eleven diacritic marks were used to identify distortions. Each diacritic was introduced individually to allow time for proper ear training for each distortion. After group training/ practice examples, authors individually transcribed 10 speakers’ datasets, establishing a reliability rate of 86%. The authors then independently transcribed single word productions from 39 speakers who had sustained left hemisphere stroke. Syllables were divided into onset, nucleus, and coda. Syllable boundaries were based on the preference of English syllables to favor onsets over coda (Cutler & Carter, 1987). Distortions were coded for type and syllable location.

### **Results**

Voicing ambiguity was the most frequently transcribed distortion (88 instances, 28.3% of total distortion,) with frictionalization in second (55, 17.7%). These results are consistent with many other studies that used narrow phonetic transcription (e.g. Haley, Shafer, Harmon, & Jacks, 2016; Hall, 2017). Of the distortions relating to tongue-position, tongue raising was the most frequently observed distortion (40, 12.9%.) In deciding which syllable component has most distortions, it is most relevant to compare the onset and coda because these positions have consonantal distortions, while the nucleus of the syllable is more likely to have distortions related to tongue body position. There were 141 recorded distortions in the onset position and only 59 distortions in the coda position. There were 111 distortions in the nucleus.

### **Discussion**

It is encouraging that the distortion frequencies followed a similar pattern to previous studies. The results suggest a higher prevalence of consonant distortions in the onset position. This finding may also be due to increased perceptual sensitivity at the beginning of words and wider tolerance of allophonic variation for word-final sounds. The possibility of perceptual differences of dialectal variation needs to be examined. Because many of the participants speak a variation of Southern American English or African American Vernacular English, dialectal differences may have appeared as distortions and been incorrectly coded as such.

Addison Francis, Alexandra Hay  
*Biofeedback Techniques in the Treatment of Dysphagia*

Faculty Mentors: Steinbrenner & Page

### **Purpose or Research Questions**

*Research Question:* "In adults with dysphagia, do biofeedback techniques improve therapy outcomes?"

*Purpose:* The purpose of this systematic review was to examine biofeedback techniques alone, or in combination with various swallowing therapy techniques in order to determine their effectiveness in improved therapy outcomes.

### **Background**

The patients within our systematic review acquired dysphagia as a result of: Alzheimer's Disease, Parkinson's Disease, Stroke, Head & Neck Cancer, and other unspecified neurologic injuries. Dysphagia is difficulty with swallowing. Biofeedback can be defined as the technique of using equipment to reveal to patients some of their internal physiological events, normal and abnormal, in the form of visual and auditory signals. This allows the patient to learn how to manipulate these otherwise involuntary or unfelt events (Bogaardt, Grolman, & Fokkens, 2009). The biofeedback techniques used within our systematic review include: digital accelerometry, surface electromyography (sEMG), ultrasonography, neuromuscular electrical stimulation, mechanomyography, high-resolution pharyngeal manometry, and simple graphic illustrations. Within the present literature, there is limited reliable research regarding the efficacy of biofeedback techniques in the treatment of dysphagia.

### **Methods/Proposed Methods**

Within this systematic review, the researchers searched two databases (Pubmed and CINAHL) using the following search terms: Dysphagia, Deglutition, Swallowing Disorders, Biofeedback, Visual Biofeedback, Surface Electromyography (sEMG), Mechanomyography (MMG), Ultrasonography, Ultrasound. Next, the researchers began an abstract review using the following inclusion criteria: Inpatient, Outpatient, Cerebrovascular Accident, Head & Neck Cancer, Neurodegenerative, TBI, age 19 or older. Then, a full-text review was completed using the following exclusion criteria: Private Practice, Non-peer reviewed journals, and Non-English Articles. Upon completion of the full-text reviews, the researchers conducted full-text quality appraisals using The Joanna Briggs Institute Critical Appraisal Tool (JBICAT). Intra-rater reliability was established at 95% on the quality appraisal reviews.

### **Results/Anticipated Results**

In the initial search after deduplication there were 580 articles. Upon completion of the abstract review, 557 articles were excluded due to improper topic and abstracts, leaving 21 articles for full-text review. Of those full-text reviews, 4 were excluded due to improper topic. 17 articles were appraised via JBICAT. Due to improper inclusion criteria, two of the articles were excluded, leaving 15 for data extraction. This systematic review includes 7 quasi-experimental studies, 3 case reports, 3 text and opinion reports, and 2 case control studies.

### **Discussion**

All 15 articles reviewed within this systematic review indicated that biofeedback techniques lead to improved therapy outcomes; however, due to small sample sizes and lack of randomized controls, the reliability of these studies is questioned. This systematic review revealed that further randomized control studies regarding biofeedback techniques in the treatment of dysphagia are necessary in providing reliable information regarding treatment and improved therapy outcomes.

Jenna Hall

Faculty Mentor: Katarina Haley

*Errors in Nonwords vs. Real Words after Left Hemisphere Stroke*

**Purpose:** To determine whether real words or nonwords evoke more frequent errors among speakers who have suffered a left hemisphere stroke and analyze potentially confounding factors.

**Background**

The clinical implications of prompting stroke victims to repeat nonwords has not yet been studied in much detail. Maas and colleagues (2002) incorporated nonwords in their study of phonological complexity's role in treatment of aphasic adults. They suggested that the use of nonwords may have limited their outcomes and are weaker for treatment of adults than real words because they do not allow for the incorporation of lexical and semantic levels of processing. Saito et al. (2003) studied the effect of wordlikeness on nonword repetition by incorporating a set of phonotactically common nonwords and phonotactically uncommon nonwords. They found that high-wordlike nonwords evoked more correct productions than low-wordlike nonwords. They concluded that this was due to strengthened phonological activation for nonwords with greater similarity to real words, suggesting that different types of nonwords are processed in different ways. To study this effect in the present study, the author included and analyzed a word complexity measure both words and nonwords.

**Method**

Audio-recorded motor speech evaluations from 73 speakers were narrowly transcribed and analyzed. Each speaker was tasked with single repetition of a subset of words and a subset of nonwords. Phonemic errors and word complexity were calculated using edit distance and complexity algorithms in Microsoft Excel. Phonetic errors were coded in one of eleven distortion categories.

**Results**

There was a greater mean percentage of phonemic errors produced in the nonword subset than the real word subset and a greater mean percentage of phonetic errors in the real words than the nonwords. Paired sample t-tests revealed that the differences between subsets were significant ( $p = .001$  for phonemic errors and  $p < .0001$  for phonetic errors). One percent of segments overall were distorted substitutions. The nonword subset had a higher word complexity average than the real word subset. When samples of the real words and nonwords were matched for complexity and their means were calculated, real words still had a greater mean percentage of distortion errors ( $p = .0001$ ), but the word type difference was no longer significant for phonemic errors ( $p = .15$ ). Lastly, 17.7 percent of nonwords were incorrectly produced by speakers as real English words.

**Discussion**

The greater rate of phonemic errors in nonwords aligns with what was hypothesized. The greater rate of distortion errors in real words was unexpected. The tendency to fully substitute, add, or delete phonemes in nonwords and to only distort the articulation of phonemes in real words could be a factor of the more familiar phonological loads present in real words. The elimination of the phonemic error effect when the subsets were matched for complexity implies that word complexity contributed to the initial significant difference in phonemic error frequency for words and nonwords. Future studies should include larger subsets of nonwords and real words that are matched for complexity, as well as a greater variety of elicitation tasks.

Kaylene King

Faculty mentors: Margaret T. Dillon, Meredith A. Rooth

*The Effect of Low-Frequency Acoustic Cues on Speech Perception in Noise for EAS Recipients*

### **Purpose**

This retrospective review aims to assess the benefit of low-frequency acoustic cues on a speech-in-noise task in participants listening with electric-acoustic stimulation (EAS).

### **Background**

With the development of atraumatic surgical techniques and shorter, more flexible electrodes, cochlear implant (CI) recipients have demonstrated postoperative residual hearing preservation in the implanted ear. As a result, these recipients have access to low-frequency acoustic cues either naturally or through the use of a hearing aid (HA), while maintaining audibility of the mid- to high-frequency information through electric stimulation provided by the CI in the same ear. This ipsilateral combination of technologies is known as electric-acoustic stimulation (EAS). The addition of acoustic low-frequency cues to electric stimulation may be beneficial for speech recognition in fluctuating maskers. This benefit has been demonstrated in bimodal listeners, who listen with a HA in one ear and a conventional CI in the other. Cochlear implant recipients with hearing preservation in the implanted ear may also demonstrate better speech recognition in fluctuating maskers when listening with EAS as opposed to the CI-alone.

### **Methods**

The speech recognition of CI recipients listening with EAS was assessed at an annual follow-up using two test measures: AzBio sentences and the BKB-SIN. AzBio sentences were presented at 10 dB SNR in a 10-talker babble. The BKB-SIN test is presented in a 4-talker babble. Recorded materials were presented at 60 dB SPL. Participants were seated 1 meter from the speaker facing 0 degrees azimuth. The two listening conditions were: CI-alone (with a full-frequency electric map) and EAS (with the familiar, truncated electric map).

### **Results**

Participants demonstrated better speech perception in noise when listening in the EAS condition as compared to the CI-alone condition. This benefit is presumably due to the addition of acoustic low-frequency information.

### **Discussion**

The results of this study suggest that access to those low-frequency acoustic cues provides significant benefit to CI recipients listening with EAS. A consideration of this dataset is that testing in the CI-alone condition was conducted using an unfamiliar, full frequency map which has been shown to negatively impact speech perception. Therefore, performance in the CI-alone condition may be underestimated. However, these data illustrate the benefits of the addition of low-frequency acoustic cues in CI recipients with residual hearing in the implanted ear. In the future, we plan to investigate the amount of residual hearing necessary to experience such benefit.

Michael Smith & Katarina Haley

Faculty Mentor: Katarina Haley

*Phonetic Complexity and Speech Sound Errors in Aphasia and Apraxia of Speech*

### **Purpose**

The purpose of this study was to determine the relationship between a measure of phonetic complexity and two types of speech sound errors: phonemic errors and distortions errors.

### **Background**

Quantitative analysis of phonemic and distortions errors has demonstrated diagnostically differentiating patterns for people with different types of aphasia and related disorders (Haley et al., 2012; Odell et al., 1990, 1991; Strand et al., 2014). However, stimuli often vary substantially across studies such that some may be more error prone, due to constituent phonemes that are perceptually or motorically complex. We sought to determine the relationship between a phoneme-based phonetic complexity metric and error frequency, with the ultimate goal to normalize speech sound error data in phonetic transcription studies and potentially streamline clinical assessment. In this study, we applied a point-based complexity metric based on child phonological development--the Word Complexity Measure (WCM: Stoel-Gammon, 2009).

### **Methods**

We analyzed two speech samples. Sample A included 41 participants, and Sample B included 45 participants. All were diagnosed with aphasia, and some had apraxia of speech. Sample A participants completed 45 items ranging in length from one to six syllables and including 25 words and ten non-words. Sample B participants repeated unique and pseudo-randomly selected sets of 50 monosyllabic words. Frequency of transcribed distortions and phonemic errors and the summed phonetic complexity of each word were calculated and compiled for each speaker and word. Data from all speakers were aggregated by word, then these aggregates were averaged in groups based on target phonetic complexity, providing an average number of distortions and phonemic errors produced by the group on all words of each level of complexity (integers from 1 to 6). Results from the two samples were then combined to create two aggregates of distortion and phonemic errors.

### **Results**

Both number of distortions and number of phonemic errors related strongly to the phonetic complexity of the targets. In Sample A, the Pearson correlation between distortion errors and phonetic complexity was .60, and that of phonemic errors and phonetic complexity was .90. In Sample B, these correlations were .56 and .96. The aggregate correlations were .74 and .91.

### **Discussion**

The strong positive linear relationships between phonetic complexity and distortion errors and phonetic complexity and phonemic errors suggest that the presence of certain sounds or sound combinations within a target word has a partially predictive effect on the speech accuracy of people with neurogenic disorders affecting speech production. The effect is preserved across a group of speakers with varying aphasia severity and profiles. Despite the promising results, the WCM does not fully explain frequency of articulation errors. Some highly complex words yielded similar error rates as words with low complexity ratings. Refinement of the WCM for adults with neurogenic disorders is needed.

Lorraine Smith and Cameron Coppala  
*Disfluencies in Autism Spectrum Disorder (ASD)*

Faculty mentors: Steinbrenner & Page

### **Purpose or Research Questions**

In individuals with autism who exhibit disfluencies, what are the characteristics of those disfluencies and what interventions are used to treat them?

### **Background**

Autism Spectrum Disorder (ASD) is a developmental disorder characterized by pragmatic and social deficits in conjunction with restrictive, repetitive behaviors. Due to the diversity of symptoms and severities across the spectrum, many clinicians are unsure at times which characteristics should be classified as a part of ASD or a separate comorbidity. Disfluencies often fall into this grey area. Many people with ASD present with characteristics of a fluency disorder, but are not diagnosed with a fluency disorder clinically. The characteristics and treatment for these disfluencies is often unknown or ignored by clinicians due to the perception of these disfluencies being a lower treatment priority than pragmatic delay. However, as speech language pathologists, it is our ethical obligation to assess the whole patient, including these disfluencies.

### **Methods/Proposed Methods**

Articles were obtained through a systematic search of 5 relevant academic databases (CINAHL, PubMed, ComDisDome, PsycInfo, and ERIC), then backchaining using the most relevant articles. This initial search yielded 160 unique articles. Two reviewers independently assessed titles, abstracts, full-texts, and quality reviews in order to determine inclusion. Published appraisal tools were used to determine the quality of the articles reviewed. 10 articles met the criteria for inclusion in this systematic review.

### **Results/Anticipated Results**

Of the 10 articles in this systematic review, 7 examined the characteristics of ASD disfluencies and 3 considered treatment options. Of the 7 articles examining characteristics of disfluencies, 6 had limited-small sample sizes. All three treatment articles were single-case study designs. 8 of the articles only included participants with higher functioning autism. The types of disfluencies described include stuttering-like disfluencies, excessive atypical stuttering-like disfluencies, and typical disfluencies. At this stage, research on treatment is limited to single case studies examining fluency shaping and modification.

### **Discussion**

This review supports the continued need for further research investigating larger, more diverse samples to generalize and further develop these characteristics and treatment approaches. Results suggest that people with ASD are more likely than neurotypical controls to exhibit frequent disfluencies; however, most do not have a formal fluency disorder diagnosis, even when the diagnostic criteria for a fluency disorder are met. Furthermore, the types of disfluencies seen in those with autism are both qualitatively and quantitatively different from the disfluencies exhibited by both neurotypical people and people with a fluency disorder. Research of treatment indicates both stuttering modification and fluency shaping results in promising outcomes in reducing the frequency of stuttering. However, neither of these treatment approaches assesses the emotional component of stuttering or participants that were not higher-functioning.

Daniel Picetti, Sarah Smith, Melissa Smith

Faculty Mentors: Steinbrenner and Page

*Expressive and Social Language Outcomes of Adults with Developmental Disabilities Who Use Augmentative and Alternative Communication Systems: A Systematic Review*

### **Research Question**

In adults with developmental disabilities, how do low and high technological augmentative and alternative communication (AAC) systems and devices affect expressive and social language?

### **Background**

Augmentative and alternative communication (AAC) is commonly implemented with children in the home and school setting; plenty of research exists to support its effectiveness with improving expressive and social language in children. However, there is limited research that addresses the efficacy of AAC with adults with developmental disabilities. The present study systematically reviews the literature in order to determine how low and high technological AAC systems and devices affect expressive and social language of adults with developmental disabilities. This review may also have related quality of life implications.

### **Methods**

The authors conducted a systematic review of peer-reviewed journal articles, using key terms related to the above research question to search the following databases: CINAHL, ERIC, and PsycInfo. During title/abstract reviews, 20.3% of articles were double-reviewed, with 89.4% interrater reliability. During full-text reviews, 20% of articles were double-reviewed, with 92.3% interrater reliability. During quality appraisals, 33% of articles were double-reviewed, with 100% interrater reliability.

### **Results**

The initial searches yielded 325 articles after deduplication. After title/abstract reviews, there were 65 articles remaining for full-text reviews. Finally, 12 articles met the criteria for final inclusion. Of these final 12 articles, there were five single case designs, six qualitative designs, and one pre-post intervention design. Quality appraisals were done for 6 of the 12 articles. Current research indicates that the usage of AAC by adults with developmental disabilities can increase independent manding and provide more opportunities for social interaction and friendship in society. However, studies with online focus groups identified problems with AAC that served as barriers to social media usage and satisfaction. There was variability among studies regarding type of AAC, participant characteristics, and outcomes measured. However, pairing this variability with the overall positive results from the studies increases the clinical significance of this systematic review.

### **Discussion**

This systematic review aims to serve as a foundation for evidence-based practice to determine the impact that AAC usage by adults with developmental disabilities can have on expressive and social language. Many of the articles in this study have very low clinical significance due to the small sample size and the inability to generalize to the population. Despite the predominantly positive quantitative and qualitative language outcomes, more research is needed to replicate findings of the current studies on a larger and more representative scale. Future research must also investigate more strategies for intervention and implementation of low-tech and high-tech AAC for adults with developmental disabilities, as current studies noted a high variability in this area.

Taylor Simonds

Faculty mentor: Margaret DeRamus

*Expressive Communication Skills of Patients with Angelman Syndrome*

**Purpose:** To compile and analyze expressive communication data from former patients of the Angelman Syndrome Clinic at the Carolina Institute for Developmental Disabilities (CIDD) and to compare trends with prior research.

**Background:** Angelman syndrome is a rare neurodevelopmental disorder which is caused by one of four known genetic mechanisms, all of which disrupt the UBE3A expression in the region of chromosome 15. It is associated with communication difficulties, particularly in expressive communication. The CIDD has housed an interdisciplinary assessment and consultation clinic for individuals with Angelman syndrome since 2012. During many patients' visits to the clinic, the Communication Matrix was completed, which assesses expressive communication skills and accepts any communication modality, including nonverbal gestures, speech, sign language, and augmentative and alternative communication (AAC). The Communication Matrix organizes skills into four reasons to communicate (to refuse, obtain, interact socially, and exchange information) and seven levels of communication that typically occur between birth and 2 years: preintentional communication (Levels 1 and 2), intentional presymbolic communication (Levels 3 and 4) and symbolic communication (Levels 5 and 6). Each of the 80 combinations of reasons and levels of communication is a "message," which is rated as "mastered," "emerging," or "not used" depending on consistency of use.

**Methods:** A new database was created to compile the Communication Matrix results of former patients of the Angelman Syndrome Clinic. The Matrix profiles of each patient who met inclusion criteria were accessed and their ratings for the 80 messages were coded: a 2 was coded for "mastered," a 1 was coded for "emerging," and a 0 was coded for "not used." This allowed for calculation of each patient's total score. The total score mean of the clinic sample was statistically compared with results from a similar, larger study by Quinn & Rowland (2017), while the percent of the clinic sample that had "mastered" each message was qualitatively compared to nationwide data accessible on the Communication Matrix website. Total score means were also statistically compared within the sample by genetic etiology.

**Results:** The total score means of the clinic sample and the Quinn & Rowland (2017) sample did not differ. Qualitatively, there were similarities in the percent of the clinic sample and of the nationwide sample that had "mastered" each message. In both of these samples, more patients used unconventional and conventional presymbolic communication, while few used symbols or language to communicate. Differences in total score means were statistically significant between groups of patients in the clinic sample with different genetic etiologies of the syndrome.

**Discussion:** Results suggested that the expressive communication of patients of the Angelman Syndrome Clinic reflected that of individuals with Angelman syndrome across the country. Genetic etiology may also influence the development of expressive communication. This effort to collect data from patients of the Angelman Syndrome Clinic via Communication Matrix results will likely continue beyond the scope of this project. Ongoing collection and analysis of such data, and comparison with other samples, would help to develop a broad understanding of the communication profiles of individuals with Angelman syndrome, along with different factors associated with expressive communication development in this population.

Arielle Abrams, Ashleigh Starnes, Stephanie Noble      Faculty mentors: Steinbrenner & Page  
*Audiological Considerations for Individuals with Cerebral Palsy, Deafblindness and Autism Spectrum Disorder*

### **Research Question**

What is the evidence regarding audiological assessment, management, and outcomes of children with hearing loss and multiple disabilities- specifically cerebral palsy, deafblindness, and autism spectrum disorder.

### **Background**

Research suggests that 30-40% of children with permanent hearing loss also have other co-occurring disabilities (Fitzpatrick, Lambert, Whittingham, & Leblanc, 2014). According to Roush, Holomb, Roush, & Escolar (2004), the most common comorbidities with hearing loss include learning disorders, intellectual disabilities, attention disorders, visual impairment, and cerebral palsy. Such conditions can make conventional methods of diagnosis and management of hearing loss more difficult than when working with typically developing children with hearing loss.

### **Methods**

Electronic search of the CINAHL and Embase databases, using the following search terms: Key search terms included variations on (1) hearing loss, (2) childhood, (3) Cerebral Palsy (CP), (4) Autism Spectrum Disorder (ASD), (5) Deaf-Blindness, (6) audiological assessment, (7) treatment, and (8) outcomes.

Each step in the systematic review process was independently conducted by the three authors. No less than 20% of articles were double-reviewed for each step.

Quality was judged by using validated quality measures provided by the Joanna Briggs Institute.

### **Results**

Data extraction was conducted on 13 articles (122 nonduplicated articles initially, 78 included after title and abstract screen, 23 included after full text review). 10 articles, the majority of which were about deafblindness and cerebral palsy were excluded after they revealed that they were too specific to provide generalizable information as was relevant to our research question or were lesser quality studies. Data extraction was completed on articles relevant to Autism Spectrum Disorder and revealed that pictures, modeling, patient participation, and consistent routines are essential to audiological assessment, that both cochlear implants (CIs) and hearing aids can be used, and that outcomes are generally positive, but may not be as drastic as those seen in their neurotypical peers. Autism Spectrum Disorder cannot be "cured" by the use of amplification.

### **Discussion**

Overall children with hearing loss and ASD have positive outcomes with both hearing aids and CIs though it is important to maintain reasonable expectations regarding speech and language outcomes and the persistence of behaviors characteristic of ASD. In addition, more research needs to be done for all three diagnoses in order to improve audiological management.

Danielle Mitton and Candace Neufville

Faculty Mentors: Page & Steinbrenner

*Efficacy of Work-Based Hearing Conservation Programs: A Systematic Review*

### **Research Question**

In occupations with high risk of noise exposure, how effective are hearing conservation programs in reducing the occurrence of noise induced hearing loss?

### **Background**

Occupational noise-induced hearing loss (NIHL) has a global estimated prevalence of 16-24% (Nelson, Nelson, Concha-Barrientos & Fingerhut, 2005). NIHL primarily impacts communication abilities, but can also cause other negative consequences such as depression, social isolation, and increased risk of accidents in the workplace (Hetu, Getty & Quoc, 1995). Occupations such as mining and construction are at the highest risk for NIHL (Masterson, Tak, Themann, Wall, Groenewold, Deddens & Calvert, 2013). Other occupations not previously associated with excessive noise have begun to be studied and are also showing risk for NIHL, including occupations such as baristas and daycare employees (Pursley & Saunders, 2013; Gebauer, Scharf, Baumann, Groneberg & Bundschuh, 2016). In 2014, a Cochrane systematic review looked at current interventions to prevent occupational NIHL. Articles through January 2012 were included, and their results showed little evidence of effectiveness of hearing conservation programs (HCPs) (Verbeek, Kateman, Morata, Dreschler & Mischke, 2012). Our purpose for this systematic review is to review the current literature and investigate whether any new advances or improvements in HCPs have been made since 2012.

### **Methods**

Our systematic review was conducted using two databases, PubMed and CINAHL. Specific search terms used were hearing conservation programs AND noise-induced hearing loss AND occupation. The publication dates of articles searched was restricted from February 1, 2012 to January 31, 2018, and results were limited to full text, research performed on humans, and English as the publication language. Other exclusion criteria include non-peer reviewed articles, and research including secondary and post-secondary students. Quality appraisal was completed using The Joanna Briggs Institute Critical Appraisal tools.

### **Results**

We found 47 articles using the specific search criteria above. After de-duplication, Title/Abstract, and Full-text review, 8 articles remain under review to be analyzed. Interrater reliability was acceptable at 89% for Title/Abstract review and 100% for Full-text review.

### **Discussion**

In general, hearing conservation programs are somewhat effective in preventing NIHL. Five out of eight studies showed effective HCPs, however no effect sizes were reported. Confounding variables such as age, recreational noise, and incorrect use of hearing protection devices were not well controlled for. Overall, the quality evidence for efficacy of work-based hearing conservation programs was low-to-fair.

Some advancements in hearing conservation efforts were noted since the 2014 Cochrane Review, including computer-based education, incorporating DPOAEs into monitoring, and use of ear-level personal noise dosimeters. Future research should incorporate these tools in determining their long-term effects, as well as controlling for confounding variables in a well-designed study.