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Students with mild bilateral (MBHL) or unilateral hearing loss (UHL) are frequently overlooked in service provision under the umbrella of special education services as they are typically viewed as having insignificant disability (Brown, Holstrum, & Ringwalt, 2008). However, up to 50% of these students fail at least one grade during their K-12 experience, demonstrating a significant risk associated with this population (Bess & Tharpe, 1984, 1986; Most, 2006). Despite evidence of risk for failure, little research exists to aid in the identification of need for services, including risk factors or potential risk factors. The aim of this study is to fill that gap of evidence required to better identify students who may need interventions to prevent failure academically. In summary, this study is an analysis of family demographic and student characteristics in order to identify common traits among students with MB/UHL who are likely to be associated with failure in academic performance.

FACTORS CHARACTERIZING THE ACADEMIC EXPERIENCES OF CHILDREN WITH MILD BILATERAL OR UNILATERAL HEARING LOSS

by

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Approved by

Mary V. Compton
Committee Chair

In 2003, my dad pointed directly at me, and with his dying demand said, “You finish school.” He never told me when to stop and so I continued until I could go no further. This work is a culmination of that 13-year university journey and is the direct result of the love and patience of the many people it takes to support the difficult journey. This work is dedicated to each of you.

APPROVAL PAGE

This dissertation, written by Stephanie J. Gardiner-Walsh, has been approved by the following committee of the Faculty of The Graduate School at The University of North Carolina at Greensboro.

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To my husband: Tim—You have been through the wild rapids of this journey more than anyone in my life, and you still manage to somehow love me. You have cooked, you have provided, you have listened, you have been my tech-support, and most of all you have been my stability when I had no ground to stand on. I am incomprehensibly lucky to have and your family in my life. I can't say, "I love you" enough to really tell you what that means to me. 143-8.

To my parents: Mom, Dad, Rick (i.e., Dad2) — This journey has been more than 13 years for you, it has been my lifetime. I know that I have been difficult to deal with, emotional, and at times unbearable. You have wiped my tears of frustration and tears of joy. Most of all, you have prayed for me when you knew how much I needed that comfort. As a first-generation college graduate, this is for you. I would not have made it through your push behind me. My completion is *our* completion. This was not a journey I made alone.

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CHAPTER I

INTRODUCTION TO STUDY

Introduction

Students with mild bilateral (MBHL) or unilateral hearing loss (UHL) are frequently overlooked in service provision under the umbrella of special education services as they are typically viewed as having insignificant disability (Brown, Holstrum, & Ringwalt, 2008) that do not warrant educational support services. However, up to 50% of these students fail at least one grade during their K-12 experience, demonstrating a significant risk associated with this population (Bess & Tharpe, 1984, 1986; Most, 2006). Despite evidence of risk for failure, little research exists to aid in the identification of need for services, including risk factors or potential risk factors for these students. The aim of this study is to fill that gap of evidence required to better identify students who may need interventions to prevent their academic failure. In summary, this study is an analysis of family demographic and student characteristics in order to identify common traits among students with MB/UHL who are likely to be associated with failure in academic performance.

Background of the Problem

Children who have mild or unilateral hearing loss (MBHL/ UHL) are often assumed to demonstrate little or no potential impact of the hearing loss on their progress in education or social life (Bess & Tharpe, 1984; Giolas & Wark, 1967; Wake &

Poulakis, 2004). Historically, these children are frequently omitted from research pertaining to deaf children as their hearing loss is perceived as low-impact, easily compensated for, and unrepresentative of the most detrimental impact of hearing loss in language or literacy development. Both medical and educational perspectives consider persons with MBHL or UHL to have a minimally disabling condition that is remediated through amplification or adapted for through the use of the unimpaired ear.

Although not always recognized as a handicapping condition, this seemingly mild form of hearing loss has been the focus of limited research to identify the factors that cause the presence of mild or unilateral hearing loss to negatively impact academic outcomes (Bess & Tharpe, 1984; Briggs, Davidson, & Lieu, 2011; Brown et al., 2008). Both MBHL and UHL have historically had little research to direct and inform teachers and specialists on the required modifications, accommodations, and specialized instruction beyond the inclusion of amplification technology needed for success in the classroom (Ross, Gaffney, Green, & Holstrum, 2008). In fact, most of the research that has been conducted in these areas appeared in two bursts, once in the late 1980s and again since 2012. Trends of the articles by year and hearing loss type can be found in Figure 1. Of the 60 articles identified, 50% (n=30) of the articles published focused solely on unilateral hearing losses, 43% (n=26) focused on only mild-to-moderate hearing losses, and the remaining 7% (n=4) combine research focused on both mild and unilateral hearing loss (Figure 2).

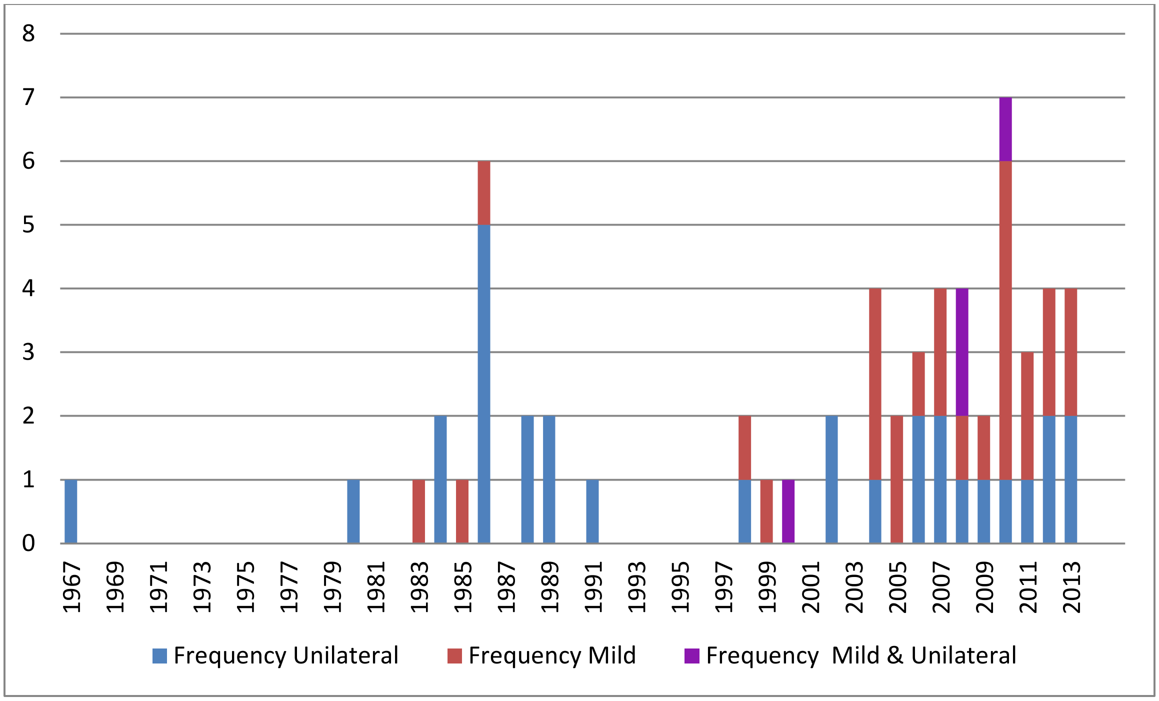


Figure 1. Frequency of Publications Related to MB/UHL. This figure compares the presence of research articles by type of hearing loss from 1967 to 2013.

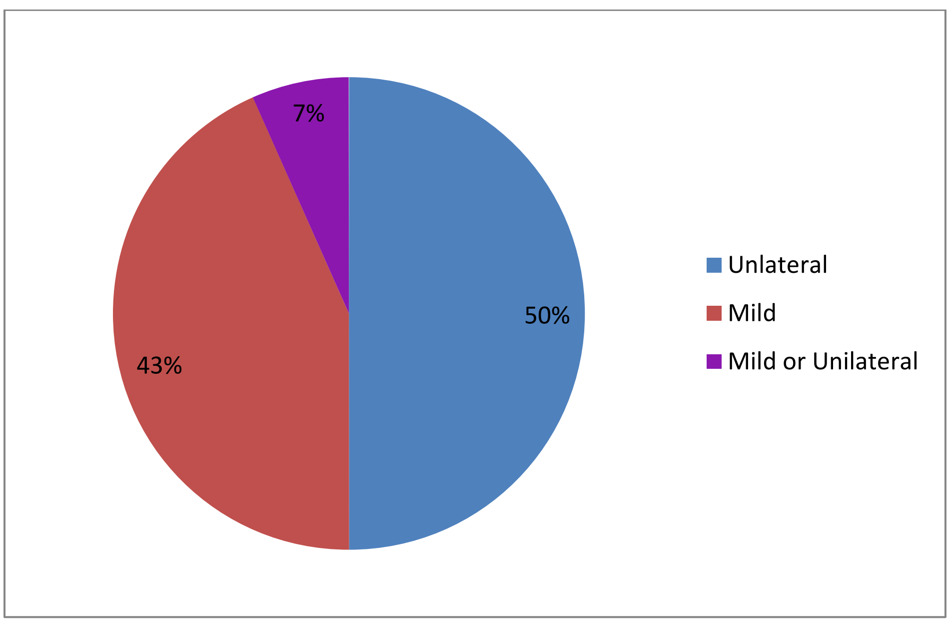
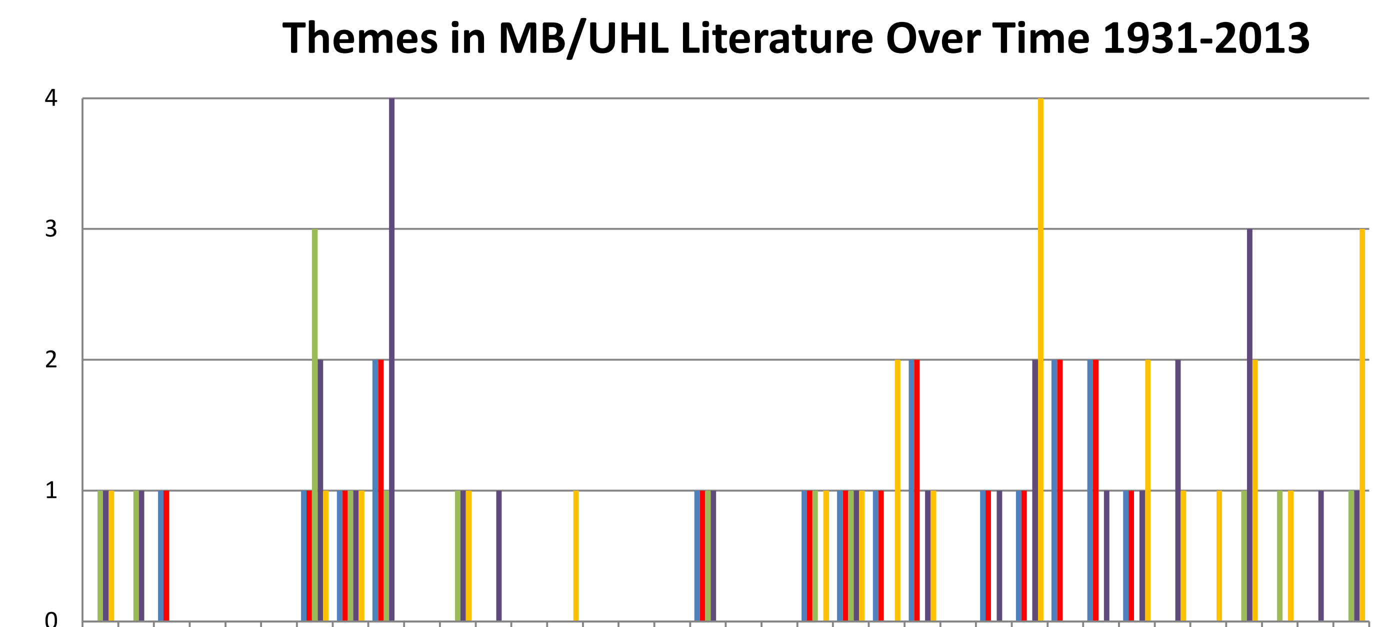


Figure 2. Percentage of Articles By Hearing Loss Type. This figure compares the percentage of articles of each hearing loss type.

Five common themes surfaced in articles related to MB/UHL between 1967 and 2013: (a) language, (b) literacy, (c) quality of life, (d) academic/functional performance, and (e) audiological assessment and management. In each of the five common themes identified trends in research prevalence also appear (see also Figure 3). In language and literacy studies, the literature remains a constant trend over time, with the highest interest appearing during the late 1990s to mid-2000s. This is consistent with the need for language and literacy demands politically and socially. More recently, an increase in audiological treatment and management has been a key feature of MB/UHL manuscripts. This parallels the current trend of research in amplification technology for more profound losses seen in literature. In both cases, quality of life literature has appeared to parallel the impact of such research and it focuses on the over-all well-being and adjustment of a child. Despite having a presence in the literature, investigations of the impact of the mild forms of hearing loss continue to be lacking in comparison to research focused on the more severe forms (moderate, severe, and profound) of hearing loss. Smart and Smart (2006) claim that many of these gaps are due to the "powerful influence of models of disability . . . which determine which . . . experience of disability is studied and taught" (p. 29) and how much or how little it is studied. With continued disregard for this population of students with hearing loss, the teaching community has the potential to create another generation of students with mild forms of hearing loss who are unrecognized, unassisted, and unable to fully access the academic world leaving those children with unfair disadvantages when compared to their hearing peers.



	1931	1964	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Language	0	0	1	0	0	0	1	1	2	0	0	0	0	0	0	0	0	1	0	0	1	1	1	2	0	1	1	2	2	1	0	0	0	0	0	0
Literacy	0	0	1	0	0	0	1	1	2	0	0	0	0	0	0	0	0	1	0	0	1	1	1	2	0	1	1	2	2	1	0	0	0	0	0	0
Quality of Life	1	1	0	0	0	0	3	1	1	0	1	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1
Academic/Functional	1	1	0	0	0	0	2	1	4	0	1	1	0	0	0	0	0	1	0	0	0	1	0	1	0	1	2	0	1	1	2	0	3	0	1	1
Audiological	1	0	0	0	0	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0	1	1	2	1	0	0	4	0	0	2	1	1	2	1	0	3

Figure 3. Thematic Prevalence of Literature over Time. This figure illustrates the theme of research articles on mild bilateral and/or unilateral hearing loss.

Overall, the unresolved issues in the area of MB/UHL is who to serve, when to serve, and how to serve these students. In order to answer these academic intervention ambiguities, we must first understand common trends among this population related to demographics, academic struggles, academic success, personal characteristics, and social characteristics. By defining the trends in such data, we can begin to determine service delivery models that address the needs of the academically at-risk members of this population to reduce their rate of failure compared with that of the general population of students who do not have hearing loss.

Statement of the Problem

Through a critical review of the literature, fully explored in Chapter 2, a gap in knowledge has been revealed directly related to the identification of students with MB/UHL who have potential risk for academic and social failure. It has been shown that specific performance detriments in language, literacy, social development, and overall academic performance may occur in the MB/UHL population (Most, 2006); however, it continues to be unknown as to which students are exactly is at risk for these failures. In summary, studies need to be conducted to identify risk factors for children with MB/UHL in order to fill this gap in knowledge so that these students may receive appropriate educational and support services to facilitate their academic and social development. By filling this gap, it is likely that services providers will be able to better identify and intervene resulting in a reduction of failure rates for these children.

Purpose of the Study

The purpose of this quantitative research study is to identify any possible commonalities in characteristics that may be useful in aiding current teachers and medical professionals in identifying children with MB/UHL who may be most at risk for academic failure. Academic failure, for the longevity of this paper is defined as the need for grade repetition or specialized academic intervention on an individualized educational plan (IEP). The dependent variable will be subdivided into two groups:

- Group 1 (MB/UHL, academic success)
    - Mild Bilateral Hearing Loss OR Unilateral Hearing Loss
    - No need for support services AND/OR 504 Plan
    - Never retained
- Group 2 (MB/UHL, academic failure)
    - Mild Bilateral Hearing Loss OR Unilateral Hearing Loss
    - Need for support services (IEP) OR retained for at least one grade OR Dropped Out

Independent variables will relate to the areas of audiological data, school structure, parent perceptions of student school performance and behavior, common risk factors for general populations, and hearing loss interventions (see Table 1).

Table 1

Study Factors

Audiological	
• Articulation Index • Sidedness/ Configuration	• Pure Tone Average • Amplification Usage
Services and Supports	
• Age of Identification/Onset • Early Support Services • Amplification • Presence at Birth/ Newborn Hearing Screening	• Etiology • Current Support Services • Follow-Up Frequency • Method of Detection
Parent Perceptions/ SIFTER Ratings	
• SIFTER: • Self-Advocacy	• Academics • Attention • Behavior • Participation • Communication
Parent Perceptions/ SIFTER Ratings	
• SIFTER:	• Academics • Attention • Behavior • Participation • Communication • Self-Advocacy
School Characteristics	
• School Size	• Number of Schools Attended
Child and Family Demographics	
• Child: o Gender o Race o Ethnicity o Peer Relationships o Additional Disabilities	• Family: o Household composition o Parent/Guardian educational level o Community Setting o Language

The population to be surveyed for this study includes the parents of public school students who have mild bilateral or unilateral hearing loss and are between the ages of kindergarten and 12th grade and/or high school graduates that completed their diploma within the past four years. Geographic boundaries were set within the United States, but included U.S. military base schools domestic and abroad. Participants were recruited through online survey distribution using public forums, list serves, and support groups as well as direct recruitment through local educational agency professionals.

Significance of the Study

The significance of this study lies in the potential to identify the academic and functional support needs of students who are often excluded from special education services because of the perceived low-impact associated with a mild status of disability. By determining which students are most at risk, teachers of students who are deaf or hard of hearing, audiologists, and speech-language pathologists can more effectively determine and monitor students who are likely to have academic needs. By preventing failure through interventions early on in a student's schooling, students have the potential for higher long-term academic achievement.

Primary Research Questions

There is one overarching question for this study, divided into 6 sub-questions that were used as the basis for data collection.

Are there differences between children with mild bilateral and/or unilateral hearing loss who are successful in school and those who fail academically in any of the following areas?

- Audiological
- Early Services and Supports
- Parent Perceptions/ SIFTER ratings
- School Characteristics
- Child Demographics
- Family Demographics

Each of these research questions was paired with research-based survey question and data collection methods outlined in the Appendix A: Research Design Logic Model. This model outlines the overarching research questions of the study, areas used to examine these questions, survey questions used to address the overarching question, and the analysis tools/procedures.

Hypotheses

For each of the six subsets, the hypothesis is the same:

- H_0 = There is no difference between children with MB/UHL who have academic failure and those who have academic success ($\mu_1 = \mu_2$).
- H_1 = There are differences between children with MBHL who have academic failure and those who have academic success ($\mu_1 \neq \mu_2$).

One goal of this study is to determine if a pattern among students with mild and/or unilateral hearing loss does in fact exist between students who are academically successful and those who fail academically. Building on the concept that there likely is a difference, this study then seeks to show which factors most influence the differences between groups.

Research Design

Approximately 250 parents of children with mild or unilateral hearing loss were asked to complete an online survey using Qualtrics Online Survey Software regarding demographic data about their child with mild bilateral or unilateral hearing loss. Additional data about parent perception of student success, student academic progress, and student hearing status was conducted simultaneously using the Screening Instrument For Targeting Educational Risk (SIFTER) within the survey process (Anderson, 1989). Data was analyzed in two stages: First, univariate procedures were conducted to find overall trends among variables; secondly, a discriminant analysis was conducted to determine if factors within a subset could predict group belonging of participants by common characteristics.

Definition of Terms

American Sign Language (ASL)—manual communication modality used developed within the United States and used within some English-speaking countries, including Canada. ASL has its own linguistic system, and is not a direct representation of spoken American English.

Articulation Index—a tool used to predict the amount of speech that is audible to a patient with a specific hearing loss. The AI reading for a given patient can range from 0-100, representing the proportion of the average speech signal that is able to be heard. The articulation index can be used with both an aided and unaided audiogram.

Asymmetrical Hearing Loss—describes a pattern of audiogram where the left and right have different degree and configuration of hearing loss. Unilateral hearing loss is one form of asymmetrical hearing loss. Also included are ears with different degrees of hearing loss (e.g. moderate and profound) or configuration (e.g., high frequency vs. low frequency).

At-risk—a general term which refers to a sub-group of students identified as having increased statistical potential for academic failure or drop-out. Most often these students are defined by the National Center for Educational Statistics (Moore, 2006).

Auditory Oral—see *oral communication.*

Auditory Verbal—see *oral communication.*

Bilateral hearing loss—hearing loss present in both ears. Hearing loss may be symmetrical or asymmetrical; conductive, mixed or sensorineural; fluctuating or stable.

Classroom Amplification—any type of amplification within the classroom setting that a child may use, but is not personally worn including sound field systems, FM systems, speaker systems.

Conductive Hearing Loss—occurs when there is a problem conducting sound waves anywhere along the route through the outer ear, tympanic membrane (eardrum), or ossicles (middle ear bones) because of damage, blockage, disease, illness, injury, absence, or other factor. Conductive hearing loss is confirmed using bone conduction measurements (ASHA, 2015)

Cued Speech—a manual communication modality that allows deaf and hard of hearing users to see the phonemes of spoken language through a combination of eight hand-shapes, five facial placements, and natural mouth movements or spoken language

Deaf Culture—social beliefs, behaviors, art, literary traditions, history, values, and shared institutions of communities that are affected by deafness and which use sign language(s) as the primary mode of communication

Deaf or hard of hearing (D/hh)—refers to all persons with hearing loss, including those who use any form of communication (ASL, Cued, Oral, SEE, etc.). The term "Deaf" references members of Deaf Culture. The term "deaf" will refer to a general definition of persons with any degree of hearing loss. In the case of this manuscript, D/hh can be used to include the terms D/deaf, hard of hearing, hearing impaired, person with hearing loss, and person with hearing difficulties.

Failure—repetition or failure of at least one grade due to limited growth or performance, not related to poor instruction; need for academic support (not environmental modifications) and/or specialized instruction via an Individualized Education Plan (IEP) with academic goals. These students may also be included on Section 504 plans, but the presence of a 504 Plan does not constitute failure.

Fluctuating Hearing Loss—hearing loss that changes over time or is unstable at the current time, changing because of factors such as disease, surgery, or infection

Functional Skills—skills defined by special education service provision documentation as skills needed for academic performance, social performance, attention, secondary education pursuit, career performance, and acceptance/adjustment to disability.

Hard of Hearing—persons with any degree of hearing loss or communication modality; most frequently refers to persons with at least some degree of usable hearing, but may be individually defined (Leigh, 2009). Hard of hearing persons may or may not feel belonging in the Hearing or Deaf Worlds, but may also feel full membership (Grushkin, 2003).

Individual Education Plan (IEP)—educational and legal documentation addressing the needs of a student with disability in the educational setting who, because of the disability, has negative impact on educational progress. The IEP ensures accommodations, targets goals for progress, and assures due process.

Loads Heavily—a phrase used to describe the importance of a factor in a discriminant analysis. Factors which are "heavily loaded upon" contribute strongly to the differences between groups in a model of group differences. For the purpose of this study, values on the structure matrix that are greater than 0.3 are considered important for differentiating between groups.

Mild bilateral hearing loss (MBHL or MB)—a hearing loss as determined by an audiological evaluation and graphed on an audiogram with a pure tone average (PTA) at 500, 1000, 4000 Hz that falls in the range of 16-40dB HL present in both ears (ASHA, 2012, Clark, 1981). Hearing loss may be symmetrical, asymmetrical, conductive, sensorineural, mixed, fluctuating, or stable.

Mild form of hearing loss—the degree of hearing loss that has fluctuating thresholds and referencing terms including, but not limited to; slight, mild, normal-to-mild, slight-to-mild, high-frequency, minimal hearing loss, slight impairment, near-normal, and partial. For this study, mild form of hearing loss will refer to all persons with mild or unilateral hearing loss.

Mild hearing loss (MHL)—A hearing loss as determined by an audiological evaluation and graphed on an audiogram with a pure tone average (PTA) at 500, 1000, 2000, and 4000 Hz that falls in the range of 16-40dB HL (Anderson, 2011; Clark, 1981; see Figure 4).

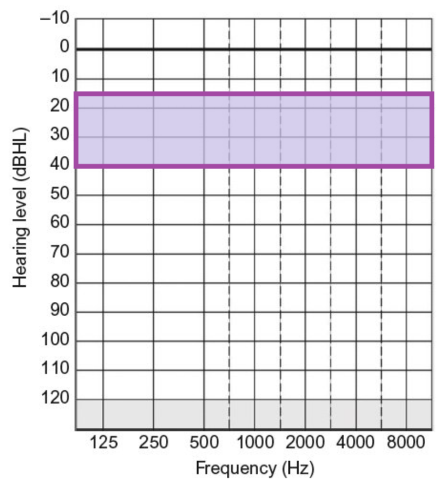


Figure 4. Mild Hearing Loss. This figure illustrates the range of mild hearing loss according to Anderson (2011).

Mixed Hearing Loss—a combination of conductive and sensorineural hearing losses present in the same ear (see also *Conductive Hearing Loss* and *Sensorineural Hearing Loss*).

Oral Communication—the use of spoken language, audition/ listening, and speech reading to access direct communication without the use of manual language; typically describes the use of spoken language, listening, and speech reading by persons with hearing loss.

Personal Amplification—any type of personal amplification system including hearing aids, cochlear implants, and auditory trainers.

Pure Tone Average—calculation of hearing loss derived by taking the sum of the measurement of hearing loss (dB) in each ear individually at of 500, 1000, 2000, and 4000Hz from air conduction audiogram and dividing by 4.

Risk Factor—a characteristic associated with an increased risk of academic failure.

Section 504/ 504 Plan—a section of the civil rights law, Rehabilitation Act, that prohibits discrimination against individuals with disabilities. Section 504 ensures that the child with a disability has equal access to an education, including an educational plan (504 Plan) that accommodates for their needs to access the educational setting caused by a disability.

Sensorineural Hearing loss—a type of hearing loss in which the root cause lies in the vestibulocochlear nerve (cranial nerve VIII), the inner ear (including the cochlea, oval window, and auditory tube), or central processing centers of the brain.

Sidedness—in unilateral hearing loss, the ear in which a hearing loss is present.

Signed Exact English—manual communication modality used as a direct representation of spoken American English. Vocabulary is derived from American Sign Language, but is in the structure of spoken English, and is not contextually based.

Stable Hearing loss—hearing loss that to the time is not changing or progressing

Success—no repetition of grade; neither a need for academic support nor specialized instruction; environmental modifications and assistive technology for access may or may not be used; academic access via Section 504 plan may or may not be present.

Symmetrical Hearing Loss—describes a pattern displayed on an audiogram where the left and right have similar degree (e.g., mild, moderate, severe, and profound) and configuration (e.g., high frequency, low frequency, flat) of hearing loss. Simply stated, the ears may not have exactly the same hearing measurements or configuration, but they are similarly measured.

Unilateral hearing loss (UHL)—hearing loss that is present in one ear. Hearing loss may be of any degree, conductive or sensorineural, fluctuating or stable.

Summary

This study identified the population of students with mild bilateral or unilateral hearing loss who are most at risk of academic failure. This was done through both univariate and multivariate, methods aimed at locating differences among those students with MBHL and MHL who do not experience academic failure and those students with MBHL and MHL who experience academic failure. The need for such a study was identified through an extensive review of literature in Chapter 2 that highlights the five most common areas of needed research concerning students with MBHL MD MHL: audiological, literacy, language development, social, and functional. Chapter 2 also includes a discussion of general population risk factors, as these risk factors contribute in addition to those risks associated with hearing loss. Chapter 3 presents methodological practices for this study, Chapter 4 presents the results of this study, and Chapter 5 discusses the implications of the findings as well as the limitations of the study.

CHAPTER II

LITERATURE REVIEW

Introduction

The goal of this review is to establish the importance of the inclusion of children with mild bilateral or unilateral hearing loss (MB/UHL) in research regarding educational practices in the Pre-12 setting. This review examines and defines mild bilateral and unilateral hearing losses. Secondly, it establishes the prevalence of such losses as a context for the need for the proposed research. Next, it examines research in the areas of language, literacy, quality of life, functional ability, and audiological needs in order to facilitate an understanding of the current landscape for persons with MBHL and UHL. Lastly, this review examines risk/success factors among children with and without hearing loss that lead to a conclusive statement justifying the need to identify how these factors (in both the general population and the factors pertinent to children with MB/UHL) combine to affect students' academic and social progress. These perspectives were examined using a disability theory framework—establishing the power and repression influences on children with MB/UHL.

Theoretical/Conceptual Framework

Definition of Problem

The three models of disability, defined by Smart and Smart (2006) as including medical, cultural, and functional cartegorizations, are defined by polarized members, "us and them"; a binary model of existence. But what happens to the "sort of us and sort of them" persons? When applied to hearing loss, hard of hearing people (not hearing, not deaf) are culturally marginalized having no strong sense of belonging to either the majority or the minority group socially (Grushkin, 2003), medically (Bess & Tharpe, 1984), or functionally (Leigh, 2009)? This lack of a specific group association and wide variability among persons with MB/UHL has led to the exclusion of such students from social groups, educational studies, and medical foci. How then, as educators are we to ensure an equitable education for these students when we, as society as a whole, have ignored their multiple identities and forgone their inclusion in academic research? Who exactly are these children and how are they defined in our classrooms? What factors lead to success or failure in the academic setting for this population of students? What modifications and accommodations best suit this population and are these provided in the schools?

Theoretical Framework

Schroedel, Watson, and Ashmore (2003) called for the inclusion of all populations of 'deaf' children, including those with mild forms of the condition in the National Research Agenda for Postsecondary Education of Deaf and Hard of Hearing Students. However, including these children in research prior to postsecondary outcomes is also important. As a response to this call for inclusion, this review of the literature approaches the educational impact of "mild" hearing loss, specifically MB/UHL by employing two different theoretical frameworks at the forefront of discussion. The first framework is theory of disability (Smart & Smart, 2006). This review examines the impact each disability theory has on children with mild bilateral or unilateral hearing loss. The second framework uses the concept of racial binary applied to cultural identity within the Deaf World. This analysis examines the exclusion of children with MB/UHL from belonging within the Hearing or the Deaf worlds based on non-belonging by central characteristics.

Ladson-Billings (2004) argues that the landmark decision of Brown v Board of Education was not one to merely end segregation of colors, but rather, a ruling that opened a Pandora's Box in which we, as a nation, were forced to examine all areas of diversity in order to broaden our understanding and interpretation of equity in education. From this platform of expectations comes a vast study of diversity issues with often polarized ends: black or white, rich or poor, gay or straight, Christian or 'other,' Hispanic or not, male or female, disabled or abled. In the following sections, we will examine a subset of just one of these categories (disability) further defined by the deafness spectrum.

Disability is a classification defined by a larger majority of society in order to group individuals into a larger set within society. Much as Critical Race theorists (Landson-Billings & Tate, 1995) argue that race is a social construct in which people organize others to maintain or reduce power of certain persons, Disability theorists argue that the concept of disability is a power structure within each societal subset of human existence which further develops the power hierarchy (Higgins, 1992). These symbolic representations create structures that establish distinctions between "us and them" allowing for stereotyping, expectations, labels, and oversimplification of group identify

(Leigh, 2009). Despite these defined boundaries, the natural tendency of defining one's self-identify is to belong to and attempt to balance multiple categories at varying degrees of identification (Landson-Billings & Tate, 1995). For individuals with hearing within a range other than -10 to 16 dB at all frequencies (for the sake of simplicity, "deaf" or "hearing loss" will be used to refer the range of hearing loss present), this process to identify the individual self is often clouded in the gray area between hearing and deaf.

Disability theorists define disability according to three different models as described by Smart & Smart (2006): (a) an variable located within a person which can be defined by objective measures—Biomedical, (b) an interaction between an individual, disability, and environment—Functional (Educational) Model, or (c) a sociologically defined minority group – Sociopolitical/Power Model. In a Biomedical Model, deaf individuals are easily classified by boundaries provided through audiometric assessments; mild loss, moderate loss, severe loss, profound loss. The definition of belonging to such a group is clearly defined by lines on a chart indicating ranges for specific categories and has little to do with functionality, aid-ability, or communication option. Inadvertently, this model strips power from the labeled individual by creating a sense of brokenness. In a Functional Model, medical definitions are considered; however, setting defines the disability. For example, a deaf person who is in an environment that does not require access to audition because of captioning or complete access to manual communication is considered non-disabled. However, the inclusion of auditory announcements without visual cues in the same setting changes a deaf person from non-disabled to disabled. In this model, the person with a hearing loss and their power is defined by society's will to provide access at all times and one's ability to compensate through visual or auditory strategies. Finally, the Sociopolitical Model provides the greatest amount of variety in application among deaf persons. In this model, the medically defined disability is not viewed as a deficit, but as a variable that leads to a linguistic minority/ethnicity (Leigh, 2009). In this definition, degree of hearing loss is not considered the primary defining faction, but rather language, kinship, and a loyalty to Deaf values defines one's Deafness. In the Sociopolitical Model, power is defined by either full membership in the hearing community or the strong rejection of hearing society practices and a deep relationship with other members of the Deaf World/Deaf Community.

The intersection of racial theory and disability theory (Figure 5) identifies a marginalized group among hard of hearing children, including those with mild and unilateral hearing loss. Racial theory encompasses the designation of people into groups by belonging according to designation, type, linage, status, class, and social construct (Banton, 1998). Recognizing Deaf individuals as a unique cultural group (seen on the left in red) with its own language, beliefs, values, and identity, racial theories recognize Deafness as a category of human race through the branch of social constructs; Deaf and Hearing (seen on the right). Additionally, because of the sense of designation (seen on left in red) into groups of Us/Them (seen on right in red), racial designations allows for the acceptance of Deaf/Hearing because of the acceptance of natural, biological variations in human experiences. For persons who are hard of hearing, the full acceptance into either binary group (Deaf/Hearing, Us/Them) does not fully apply, leaving a sense of marginalization.

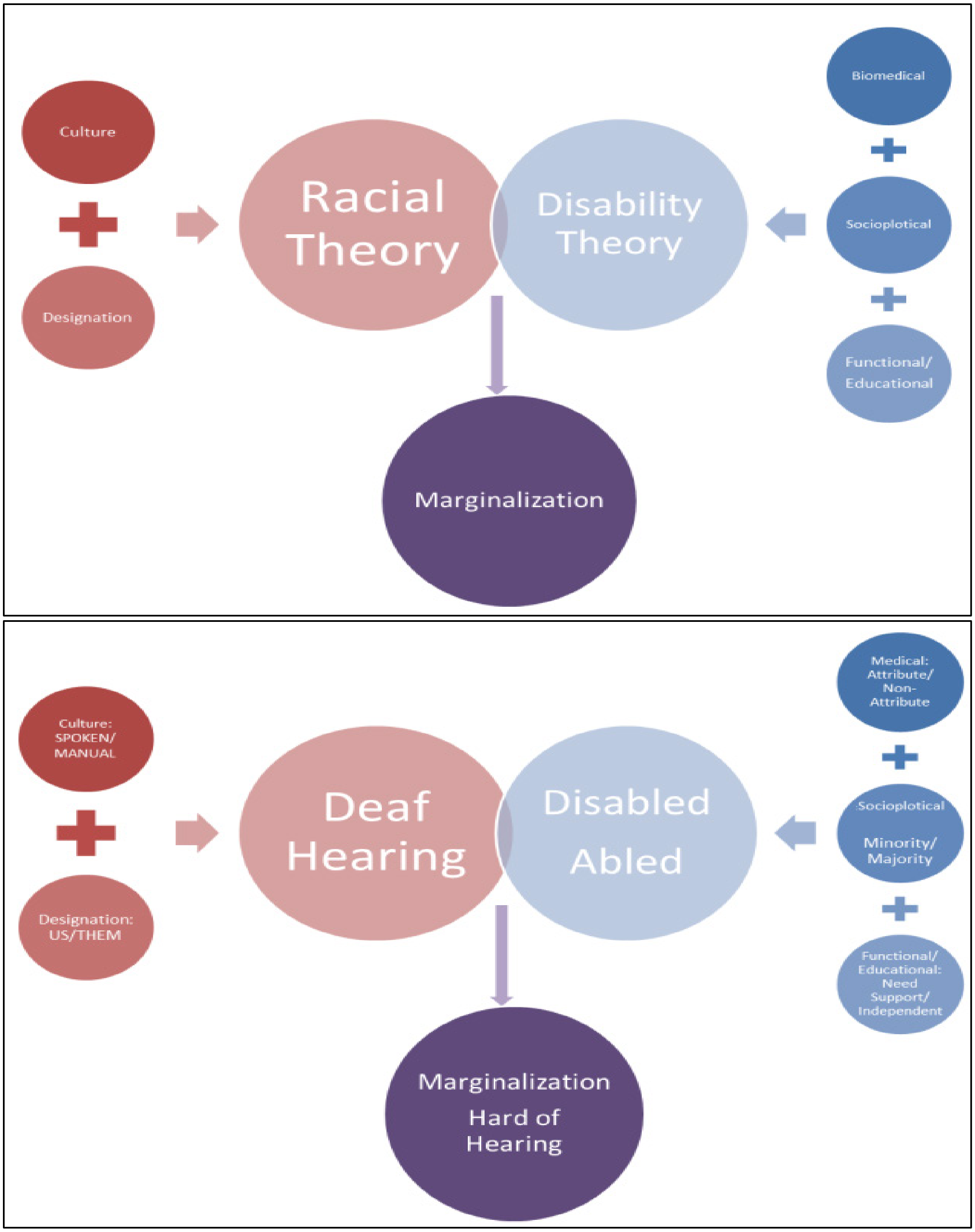


Figure 5. Intersection of Racial and Disability Theories. This figure illustrates how the intersection of racial and disability theory can be applied to the study of hard of hearing populations.

Likewise, the designations of disability also create a similar pattern of marginalization. Medical definitions of disability create (seen in the left-most circles) constructs based on presence of diagnosis. Persons are considered disabled if a condition is present. For hard of hearing children, a condition—'hearing impairment'—is present, but is often followed with an explanation that the disability it not detrimental. Socially, Deaf persons are considered part of a minority group as defined by racial theories of cultural groups. However, as already established, hard of hearing children are excluded from this group as non-entities of the Hearing or the Deaf population. Functionally/ Educationally, hard of hearing persons are classified by their need of support in academic and functional environments. In the case of hearing loss, disability is defined as either needing or not needing support. For hard of hearing persons, the need for support fluctuates and therefore, so does the definition of disability. In each of these three definitions of disability, hard of hearing persons flux between the definition of disabled and not disabled, thus leaving them marginalized.

These models of deafness are defined by polarized members, "us and them;" a binary model of existence. But what happens to the "sort of us and sort of them" persons? Hard of hearing people (not Hearing, not Deaf) are culturally marginalized having no strong sense of belonging to either the majority or the minority group socially (Grushkin, 2003), medically (Bess & Tharpe, 1984), or functionally (Leigh, 2009). This lack of grouping association and wide variability among persons has led to the removal of students from social groups, educational studies, and medical studies. How then, as educators are we to ensure an equitable education for these students when we, as society as a whole, have ignored their multiple identities and forgone their inclusion in academic research? For the purpose of this study, these theories become the central focus for justifying the inclusion of children/students with mild or unilateral hearing loss in research. Through this approach, the examination and inclusion of mild forms of hearing loss in research is critical to the success of truly inclusive general education and specialized education programs, in order to reduce the marginalization of populations who do not fit in a binary model of classification (Del Pilar & Udasco, 2004).

This exclusion model based on the binary model of Deaf Culture constitutes the basis for the need of consideration for hard of hearing children in this study. To say that this study is grounded only on a question about a subset of a population would be misrepresentative of the goal. This study aims to understand a subset so that members of the subset (MB/UHL) can begin to find their place in the world between Deaf and Hearing.

Definition of Mild Bilateral and Unilateral Hearing Loss

It is most difficult to define mild bilateral and unilateral hearing losses as historically, terminology and ranges of loss have changed. The words “mid,” “minimal” and “slight” hearing loss have been used synonymously to describe both MBHL and UHL (Ross, Gaffney, Green, & Holstrum, 2008). Likewise, the definition of MBHL and UHL has varying definitions in medical and educational communities, differing on the factors of degree of hearing loss and impact of hearing loss. To clarify this discrepancy, the American Association of Audiology has clearly defined the limits of minimal hearing losses (Anderson, 2011). The AAA defines three areas which can be considered mild medically:

- Mild—average air conduction between 20-24 dB in both ears
- Unilateral—average air conduction >20dB in impaired ear
- High Frequency—average air conduction >25 at two or more frequencies above 2000kHz

Using the medical definition established at the 2005 National Workshop on Mild and Unilateral Hearing Loss, sponsored by the Center for Disease Control and Prevention, the children whose audiograms demonstrate these areas between hearing and deaf have a mild bilateral hearing loss or unilateral hearing loss and include all those who fit into historical categories of 'mild, minimal, slight, and partial' hearing losses (Ross et al., 2008).

- Permanent mild bilateral hearing loss—a pure-tone air-conduction threshold between 16-40dB at 500, 1000, and 2000Hz or thresholds greater than 25dB at 2 frequencies above 2000Hz.
- A unilateral hearing loss—pure-tone air-conduction threshold equal to or greater than 20-40dB at 500, 1000, and 2000Hz or thresholds greater than 25dB at 2 frequencies above 2000Hz and thresholds in the good ear less than 15dB (Davis, Reeve, Hind, & Bamford, 2000).

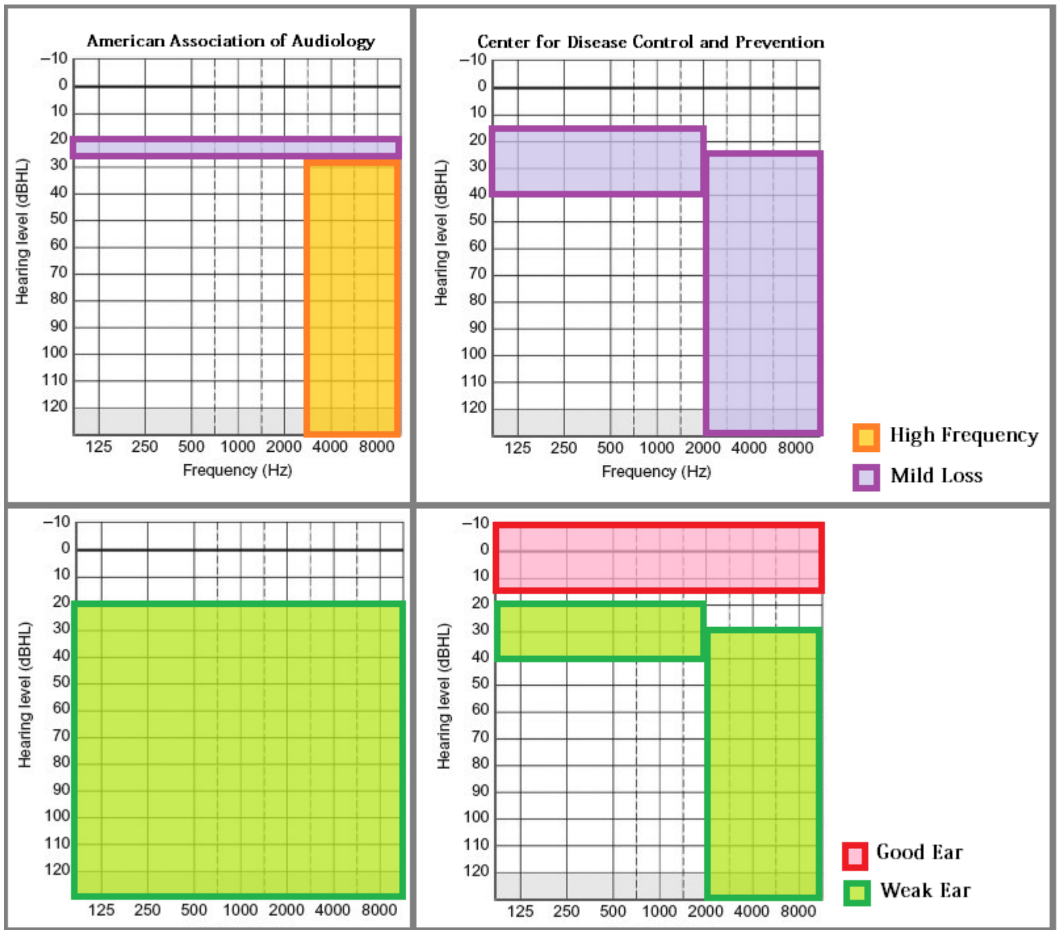


Figure 6. Comparison of Definitions of Hearing Loss. This figure compares the American Association of Audiology and the CDC definitions of mild and unilateral hearing loss.

The difficulty in the inclusion of a finite definition following decades of research with self-selected definitions of mild is that populations is that the separation of research into those defining “mild bilateral,” “moderate bilateral,” and “high frequency” losses become indistinguishable. For this reason, the review of previous research is categorized and referenced by how the original author labeled the population, but research was excluded if the range of participants strayed exceedingly from the definition provided by the AAA and the National Workshop on Hearing Loss. This judgment is strictly based on the methods and subjects included and are expressed at the author's discretion. However, to establish a broad enough sense of what is already known and may be applicable, one must accept that special education is forever dynamic and our labels are just that—labels that attempt to variable meaning on a level of hearing that has already been shown to be an ineffective method for predicting ability (Myklebust, 1947; Lane, 1963; Karchmer & Mitchell, 2003).

Prevalence on Hearing Loss

Hearing loss is considered a low-incidence condition, yet it is one of the most prevalent birth abnormalities. The Center for Disease Control (CDC) reports that between 1 and 3 in 1000 children are born with some type of detectable hearing loss. By school age, 14.6% of children ages 6-19 have some form of mild to profound form of hearing loss (Niskar, et al., 1998) . Hearing loss has been attributed to difficulties with language development, social skills, academic performance, self-esteem, emotional health, and family life (Anderson, 2011). Approximately 80% of children identified from birth to three with hearing losses often receive early intervention services to assure language development and to support families in communication choice (CDC, 2012).

According to Ross, et. al (2008) the prevalence of mild-bilateral hearing loss (MBHL) among newborns screened at birth is roughly 0.36:1000. That number increases to 10-15:1000 for school age children. The prevalence of unilateral hearing loss (UHL) also increases from 0.8-2.7 per 1000 children at birth to 30-56 per 1000 in school age children. This significant increase from birth to school age can be attributed to multiple factors including illness, progressive loss, trauma, and other causes. Irrespective of the etiology, MBHL and UHL have shown the potential, although not the guarantee, of creating developmental delays especially in the areas of foundational reading skills, behavior, and language development (Bess & Tharpe, 1984; Borton, Mauze, & Lieu, 2010; Gibbs, 2004; Ross, et al., 2008).

According to records from newborn screenings to school screenings, UHL increases from 0.36:1000 to 30-56:1000 from birth to school aged children while MBHL increases from 0.8:1000 to 10-15:1000 from birth to school age (Davis, et al., 2000; Ross, et al., 2008). The increase of MBHL and UHL between birth and school aged children has been attributed to several factors including illness, infections, disease, injury, genetics, and unknown causes. The onset of hearing loss is often unknown as the presence of MB/UHL often goes undetected until a child is screened during school evaluations (Bess & Tharpe, 1984). Demographically, Bess, Dodd-Murphy, and Parker (1998) reported that UHL is more prevalent in females than males and Everett (1960) in the left ear (52.5%) as compared to the right ear (47.5%) but right ear loss increases the risk of academic struggles (Bess & Tharpe, 1984; Oyler, Oyler, & Matkin, 1988). Further examination of 'sided' loss by Brookhouser, Worthington, and Kelly (1991) indicated that right sided loss is associated more frequently with speech/language issues and left sided loss is associated with academic and behavioral problems. These difficulties were supported by Niedzielski et al (2006) who found that children with right-sided UHL display significantly lower scores in verbal, vocabulary, and comprehension; whereas, left sided UHL is associated with significantly lower scores on nonverbal tests. Such risks may be attributed to the tendency of right-dominant persons developing language within the left-hemisphere. Without complete pathway development resulting from the result of cross-lateral brain development, children are more at risk for language delays (Bates, Dale, & Thal, 1995). Bess et al. (1998) also indicated that white children are more likely to have MBHL than African-American children and that such loss increases with age.

In research concerning both MBHL and UHL, research indicates a commonality of statistical representations of populations; both MBHL and UHL increase from birth to school age. These changes can be due to acquired losses or because of misidentification at birth. In either case, a disturbing trend has been noted: it is unknown whether or not these children need to be detected through newborn hearing screenings (Wake, et al., 2005) or if they qualify for early intervention services (Brown, Stredler, Holstrum, June, & Ringwalt, 2008). This debate remains despite evidence that many children with MBHL or UHL will experience difficulties attributed to hearing loss (Bess & Tharpe, 1984; Wake & Poulakis, 2004).

Research on Mild and Unilateral Hearing Loss

Audiological Research

As the medical perspective of audiology would predict, investigations of children with MBHL and UHL has focused on diagnosis, amplification and functionality, and etiology of ‘mild’ forms of hearing loss. Bess and Tharpe (1984) noted that unilateral hearing loss is often diagnosed later in life. This idea was supported by more recent research that affirmed that although both UHL and MBHL may be identified during universal screenings at birth or entrance into formal schooling, most children do not obtain management or support from audiology services (Davis, et al., 2000). These results are disappointing given that general research in deafness indicates that children with hearing loss who are identified early, receive intervention, and use amplification consistently are more likely to be successful academically and functionally (Luckner & Muir, 2001; Yoshinaga-Itano, 2003). Goldberg and Richburg (2004) defined a series of myths about MBHL and UHL that may help clarify why these trends are happening. Two of these myths include the opinion that (a) 'mild' losses will be identified in school screenings and (b) hearing loss between 16dB and 25dB is "normal." Such misunderstandings reflect earlier references to the multiple definition of what 'mild' hearing loss is and lack of clear-cut definitions on the implications on learning. Evidence from Powers (1999) indicates that degree of hearing loss is not the key factor for predicting outcome, but that the management of hearing the loss and a students' access to communication is a more critical factor.

Related to nature and etiology of hearing loss, Serpanos and Jarmel (2007) found that 37% of children ages 3-5 whose families actually follow-up on hearing screening referrals have confirmed outer or middle ear disorders. The most common etiologies for UHL include inner ear malformations, acquired viral and bacterial infections, neonatal toxic insuits, trauma, and genetic causes (Laury, Casey, McKay, & Germiller, 2009). Serpanos and Jermel (2007) also found MBHL was three times as likely to occur as UHL, more than half of families did not comply with treatment recommendations, and most UHL is in the mild to moderate ranges. Sensorineural and mixed losses tend to appear in these populations more frequently than conductive-only losses (Genç et al., 2013).

The functionality and the use of amplification is the second major theme in audiology-focused research. The functionality or use of hearing aids directly drives amplification research. With regards to functionality, Bess and Tharp (1984) again establish the context of needs for children with ‘mild’ hearing losses. Their research on children with UHL indicated that localization, detection of primary signals in embedded noise, high frequency signals, and syllable identification are all impaired, even when normal hearing is present in one ear. Among persons with MBHL, a negative correlation between rhyme awareness and initial phoneme awareness was observed (Gibbs, 2004). Children with MBHL also displayed abnormal scores on dichotic digit tests and pattern recognition activities (Neijenhuis, Tschur, & Snik, 2004). In general, children with hearing loss had significantly lower performance in perception of speech than their hearing peers (Gibbs, 2004; Schonweiler, Ptok, & Radu, 1998).

The use of amplification has positive outcomes for students with hearing loss, but negative trends have been observed for use among children with mild and/or unilateral hearing loss. Generally, children with hearing loss using hearing aids performed better in all domains of the Screening identification for Targeting Educational Risk Assessment (SIFTER), except for attention, and these students received more appropriate services in school. Luckner and Muir (2001) reestablished the importance of amplification usage for the success of deaf and hard of hearing students in all settings. However, Serpanos and Jarmel (2007) revealed that misconceptions of parents and primary physicians concerning appropriate audiological services lead to decreased use or initiation of amplification in children with MB/UHL. Reed, Antia, and Kreimeyer (2008) continued to confirm the negative effects of inconsistent or non-present amplification for children with 'mild' forms of hearing loss. Baskent, Eiler, and Edwards (2010). Early amplification was deemed critical as phonemic restoration was negatively affected by age from children with MBHL, whereas, scores on listening skills improved after amplification implementation for children with UHL and MBHL (Briggs, Davidson, & Lieu, 2011). Additional negative impacts of MBHL were observed in speech recognition without the use of amplification (McKay, Gravel, & Tharpe, 2008), however, there are few differences between the spectrum of mild losses (slight, mild, moderate, and high frequency losses) on the unaided Hearing in Noise Test (Vermiglio, Soli, Freed, & Fisher, 2012).

Dismal hearing aid usage has been observed across school age children with mild and unilateral hearing losses. Davis, Reeve, Hind, and Bamford (2000) found that 50% of children with UHL and 44% of children with MBH never wore their hearing aid. Twenty-six percent of UHL and 25% of MBHL wore their hearing aid all of the time. Four percent of UHL and Three percent of MBHL wore their hearing aid only in academic settings. Most common reasons for the lack of consistency or the lack of use of amplification included misperceptions of the detriment that MBHL or UHL can cause (Davis et al., 2000) and stigma associated with hearing aids/FM systems (Davis et al., 2000; Serpanos & Jarmel, 2007). With such mixed results in amplification usage, the negative impact of not hearing academic information, and the noisy acoustic environment of the classroom, it is important to continue to investigate the prescription of amplification, referral for professional services, and academic progress of students with and without amplification to increase their uninhibited access to spoken language.

Language Development

Language development encompasses two primary components; expressive/receptive language skills and speech production. In research concerning the expressive development language delays were present, as measured by the Detroit Test of Learning Aptitude, in children with MBHL and lower verbal scores were observed in children with UHL (Bess & Tharpe, 1984). These findings were affirmed in multiple studies, using multiple norm based language assessments in both children with MHL and UHL (Briscoe, Bishop, & Norbury, 2001; Dancer, Burl, & Waters, 1995; Delage & Tuller, 2007; Most, 2006; Schonweiler et al., 1998; Yoshinaga-Itano, 2003). More specifically, delays were found in receptive comprehension of language, reduced vocabulary, reduced memory of linguistic tasks, and grammatical difficulties. In contrast, multiple investigators revealed that children with MBHL or UHL perform equally to their hearing peers on standardized language development batteries (Gibbs, 2004; Wake et al., 2005). Such differences in findings concerning the language development of children with MB/UHL may be variable attributed to sampling methods, tools of measurement, or other factors such as amplification use, identification, and etiology. Briscoe, Bishop, and Norbury (2001) noted that another possibility for differences in outcomes in language development asserts that children with ‘mild’ losses have delays similar to children with specific language impairments (SLI). For example, Briscoe, Bishop, and Norbury (2001) found that children with MHL performed lower than their age matched hearing peers and peers with specific language impairments on language tests, phonological awareness, expressive phonology, memory tasks, but not phonological discrimination tasks; indicating hearing loss may affect some aspects of language development not specifically related to processing auditory input of speech.

In the area of speech production, Schonweiler et al. (1998), found that children with MBHL displayed diminished phonology skills and increased mispronunciations of /s/ sounds, consistent with the deprivation of high frequency sounds. In a later study, speech production errors continued to be reported, with the addition of speech production difficulties for children with UHL. Forty-four percent of MHL and 40% of UHL have difficulty in speech production (Davis et al., 2000). Additionally, parents report that with 15% of MHL and 22%of UHL speech production of the child was difficult to understand by the listener (Davis et al., 2000).

In contrast to the negative findings regarding the language development and speech production, Luckner and Muir (2001) in a survey of teachers of the deaf, parents of children with hearing losses, and students with hearing loss found that a perceived 'strong language command' and additional support in vocabulary and language attributed positively to the academic outcomes of students with hearing loss. In addition, early identification within the first two months of life also resulted in higher language quotients in children with any degree of hearing loss, as did intervention within the first 6 months following identification of hearing loss (Yoshinaga-Itano, 2003).

Literacy Skills

Literacy skills, similar to language skills, combine multiple areas into a general categorical grouping. In this case, literacy includes all the skills needed for reading: phonics, phonemic awareness, vocabulary, fluency, and comprehension. Luckner and Muir (2001) established that of students with hearing loss, reading abilities was among the highest predictors of positive academic outcomes, specifically in the areas of vocabulary and comprehension.

Children with mild hearing loss experience gaps in their Verbal IQ scores compared to hearing peers and continue to show varied performance outcomes in literacy skills (Park & Lombardino, 2012). Bess and Tharpe (1984) found that 38% of children with UHL demonstrated reading difficulties and 31% had difficulties in spelling. Gibbs (2004) also found that phonological awareness and vocabulary skills were lagging behind hearing peers in children with 'mild' hearing loss. Interestingly enough, Gibbs also noted that unlike their hearing peers, children with hearing loss did not directly link phonological awareness and vocabulary to success in reading. Gibbs' results were repeated by Park and Lombardino (2012) with the additional deficit in phonological memory tasks. Children with MHL frequently scored in similar ranges to those of matched hearing peers on overall reading batteries; however they differed in phonological memory and phonological discrimination (Wake et al., 2005, 2006). Unlike children with dyslexia, children with mild hearing loss experience gaps only in measurements of phonological tasks associated with reading (Park & Lombardino, 2012). It was also found that phonological awareness scores most significantly contributed to the prediction of successful readers among students with hearing loss (Cupples, Ching, Crowe, Day, & Seeto, 2014). However, as mentioned earlier, the presence or distinct study of children with MBHL and UHL is often lacking in research on the general population of children with hearing loss. For this reason, limited data is available that specifically applies to children with MB/UHL.

Academic and Functional Research

The area of functional research includes areas of general academic performance, social performance, attention, secondary education pursuit, and acceptance of hearing loss, as defined by functional performance on special education documentation. Most frequently, the SIFTER has been used to examine hard of hearing persons for risks in these domains—even though this tool does not always identify those at risk (Goldberg & Richburg, 2004). The SIFTER (Screening Instrument For Targeting Educational Risk) is a rating scale instrument designed by Dr. Karen Anderson (1989) specifically to predict academic risk for children with hearing loss by measuring the areas of academics, attention, hearing, communication, emotional, social dimensions, and class participation. In past studies of students with UHL utilizing SIFTER (Dancer et al., 1995) results have indicated that all five areas of measurement were lower than scores reported on hearing peers. Likewise, the ratings of children with MBHL attributed to persistent otitis media also resulted in poorer ratings in the areas of academics, attention, and social dimensions.

Although results seem dismal, failure in these domains is not always observed in children with MB/UHL. Through interviews and surveys conducted with families with children who demonstrate all forms of hearing loss, factors have been identified that contribute to positive outcomes in their social and functional domains.. Specifically, academic factors include family involvement, self-determination, involvement in extracurricular activities, social relationships, self-advocacy skills, communication with general education teachers, participation in pre- teaching and post-teaching experiences, early identification, strong reading skills, and high expectations (Luckner & Muir, 2001; McMillan & Reed, 1994; Reed et al., 2008). Detractors to student academic and functional success included the presence of additional disabilities and poor family-school relationships (McMillan & Reed, 1994; Reed et al., 2008). Although the population examined in these studies had more severe hearing loss, it is assumed that similar qualities would be seen in children with lesser degrees of hearing loss, as these same traits are also seen within a hearing population (McMillan & Reed, 1994).

Goldberg and Richburg (2004) emphasized that academic and functional domains are important to note as there is a misconception that children with 'mild' hearing losses are often considered to be appropriately served if preferential seating is provided in instructional settings. This myth is confirmed when examining the academic performance of children with MB/UHL who fail; 35% of MHL fail one or more grades, 32% of UHL fail one or more grades, and 50% of MBHL & UHL experience academic difficulties—even without grade repetition (Bess & Tharpe, 1984). This trend has not differed much in the nearly 30 years since these measures were conducted (Daud, Noor, Rahman, Sidek, & Mohamad, 2010; Most, 2006; Most & Tsach, 2010). The outcomes for students with MB/UHL plus additional disabilities were even grimmer (Dancer et al., 1995; Powers, 1999). For children who are assumed to have no major effects from such ‘mild’ losses, these numbers are alarming, but again the difference is not parallel to the degree of hearing loss (Borton et al., 2010). More recent research indicates that the effect of preferential seating is only effective between 4.35-6.27m from the speaker for children with UHL. This finding suggests that the myth of effective seating is only true for the closest peer relationships and for a teacher who lectures from a stationary position (Noh & Park, 2012)

Other areas that negatively affect in children with MB/UHL were the areas within social outcomes. Most (2004) found that hearing loss not only affected academic achievement and communication, but also social behaviors. Both children with UHL and MBHL were found to encounter social difficulties, leading to lower self-esteem. Social difficulties were attributed to the inability to hear clearly what conversational partners had to offer. Surprisingly, Most (2004) revealed that a non-linear curve for prediction was present based on the degree of hearing loss—showing that children with more mild forms of hearing loss actually had less positive social outcomes than peers with more significant degrees of hearing loss. Due to the lack of classroom support services, the cycle of failure and lack of social success became apparent.

Long-term educational outcomes have also been found to be related to MB/UHL. Schroedel et al. (2003) found that as in pre-12 settings, little attention is paid to hard of hearing students at the post-secondary level and young adults with MB/UHL continue to avoid support services due to their self-perceived or learned-perception that mild or bilateral hearing loss does not have an impact on their daily lives. Schroedel et al. (2003) reported that there continues to be no national standards for supporting this population;

whereas, attrition rates from post-secondary programs continue to be greater for persons with ‘mild’ hearing loss than those with support services and severe hearing losses. Additionally, there continues to be a void in minority population representation with children ‘mild’ losses than in general and deaf populations. This may be due to the tendency for over identification in behavior disorders in lieu of underlying sensory disabilities (Bess et al., 1998).

Quality of Life

Quality of Life (QoL) indicators include multiple domains of life. These include health, involvement in social domains, educational and career success or satisfaction, and impact on daily life. More specifically, Theofilou (2013) defines QoL as a five-dimensional phenomenon including areas of physical, material, social, and emotional wellbeing, as well as physical and cognitive development and activity. Several of these factors overlap other dimensions (e.g. social in academic/functional; cognitive in academic and literacy). QoL is most often categorized by two domains of measurement; general life and disease/health specific.

Research on the QoL of children with MB/UHL has been measured using general QoL scales, perception scales completed by adults, and scales specific to the acceptance of one’s hearing loss. On general QoL rating scales, children with MHL scored similarly to hearing peers on both QoL and health factors in a study by Wake et al. (2006). This study affirms findings from earlier studies that children with MHL are similar to their hearing peers in behavior and QoL (Wake et al., 2005). In contrast, children with UHL scored below their hearing peers in similar domains (Dancer et al., 1995). Several interview studies provided a more detailed insight into the way QoL is experienced by children who were considered hard of hearing (unilateral or mild bilateral) through the interviewing of parents and teachers. For example, children who were considered hard of hearing were generally viewed as average to above average students with respect to their QoL (Bess & Tharpe, 1984). In a study incorporating interviews of parents of children with MB/UHL parents believed no differences between their child with MB/UHL existed when compared to their hearing peers in the areas of friendship, relationships, employment, or income achievement. Neither students with MBHL nor UHL were perceived by parents to experience decreased overall QoL however family relationships changed negatively the more severe the degree of hearing loss present (Davis et al., 2000).

Various researchers report that higher QoL is measured in children with MB/UHL who had access to regular education because of appropriate modifications and accommodations (Luckner & Muir, 2001). This inclusivity increases the child's involvement in social and recreational activities, acceptance by peers. Clear speech, strong command of English, lack of additional disability (Schonweiler et al., 1998), and clear understanding of conversation a majority of the time (Kushalnagar et al., 2011) have also been found to positively relate to QoL for children with MB/UHL.

Risk factors for QoL present in MHL populations include the following origins: perinatal risk factors, syndromic hearing loss, cleft palate, myofuctional disorders, visual perception disorders, and mental retardation (Schonweiler et al., 1998). Factors such as racial and ethnic background and socioeconomic status were also associated with lower

QoL measurements (Schonweiler et al., 1998). These results reflect those patterns seen in general populations as risks for decreased QoL is present in children with additional disabilities, fewer financial resources, and minority groups (King et al., 2006)

Borton et al. (2010) described the results of interviews with children with UHL and MBHL designed to identify the overall QoL they experience. Results indicate that families feel a period of adjustment when a diagnosis of a hearing loss is made, much like the cycle of grieving when faced with a diagnosis of other forms of disability. Comparing UHL and MBHL populations, Borton et al. (2010) also note embarrassment with the use of amplification, coping mechanisms such as pretending conversation is understood, and lack of teacher understanding of hearing loss. On social functioning scales, Borton et al. (2010) reported that children with UHL had significantly larger ranges of variability than children with MBHL or normal hearing. Parents confirmed the perceptions of individuals with UHL with lower applied social functioning ratings than did the MBHL or hearing group parents. Social interactions of children with MB/UHL were reported by both parents and individuals as limited to small groups and with preference of one-on-one settings. Students with UHL and MBHL expressed frustration with teachers who often confused their lack of understanding of conversation as lack of effort to pay attention. This sentiment resounds Bess and Tharp’s (1984) findings that children with ‘mild’ losses “constitute a population currently ignored in our educational system” (p. 208). It also exemplifies the positive outcomes for those students with high levels of speech intelligibility (Kushalnagar et al., 2011). In summary, children with ‘mild’ hearing loss may have more biopsychosocial consequences due to lack of clear identity, meaningful peer relationships, and viable social communities (Schroedel et al., 2003); however, these difficulties can be compensated for with support.

Success and Risk Factors

General Populations

Children in the general population have several factors that have long been identified as contributing to risk for academic failure. Aside from disability, demographic factors such as socioeconomic status (SES), familial involvement, gender, race and ethnicity, and parent education levels all contribute to placing a student at-risk for failure (Jimerson, Egeland, Sroufe, & Carlson, 2000). Jimerson et al. (2000) identified during a nineteen year longitudinal study additional factors which could be used to predict academic dropout/failure risk. These factors included: (a)parental involvement (Grade 1 & 6), (b)SES (Grade 3), (c)problem behaviors (Grade 1), (d)peer relationships (age 16), and € academic achievement (Grade 1). Malinauskiene et al (2011) added to this base finding that children who displayed anxiety, depression, withdrawal, or aggression during the middle grades (6-8) were also significant risk for academic failure, particularly if they were male.

Children with Hearing Loss

Risk factors appear to differ between orally and manually educated children with hearing loss (Eriks-Brophy et al., 2007), however, for the extent of this paper, only factors for orally educated children were examined as children with MB/UHL are typically educated in general education settings using spoken language (Eriks-Brophy et al., 2007). Ericks-Brophy et al. (2007) examined the factors in orally educated children that facilitated and created barriers to educational progress for children with hearing loss. The most influential factor for success was family involvement, particularly from a two-parent family in which one parent could focus on the early language development and advocacy during school-age academic experiences. This success was paired with balancing the attention to all children and parents in the relationships within the home. Support networks including other families, medical professionals, school support services, and other parents were also highly regarded to attributing to the success of orally education children. Third, open communication with the child about high expectations, need for self-advocacy, and involvement in school community events were described by parents and teachers as highly beneficial to school success. Finally, student centered characteristics such as good communication skills, willingness to use technology for support, and involvement with peers positively attributed to success. Barriers included familial stress, guilt, burnout, overprotectiveness and lack of understanding for support needs. Negatively associated student characteristics include shyness, introversion, lack of self-confidence, inappropriate communication strategies, and lack of consistent use of amplification or technology resources.

Historical Context of Research over Time

In reviewing the body of research that focused on of with mild bilateral or unilateral hearing loss, it is important to note the pattern of articles over time and the historical context of education of children with hearing losses. One article was identified as targeting this population in 1931. Madden (1931) established that children with MB/UHL scored lower than hearing peers on IQ measures in a non-linear function to hearing loss degree. No other publication was evident between then and the 1960s that specifically focused on children with mild or unilateral hearing losses. In 1964, O'Neil published research indicating that these hard of hearing children displayed multiple behavior issues and emotional disturbances. However, in the context of deaf education, the 1960s saw an increase of Deaf Children enrollment at Deaf Schools due to Rubella, so for these children were easily overlooked in the 'mainstream setting.' This overlook would continue through the 1980s.

By the early 1980s, children with MB/UHL had all but disappeared from research publications. However, in 1984, Bess would call attention to 'minimally deaf children' in a series of articles spanning a period of 3 years. This would continue into the 1990s, however not without first being over shadowed. In 1988, the Deaf President Now movement rightfully called attention to the power within the Deaf World. Research again focused on children who used signed language and the impact of education, as well as literacy for deaf children. Several articles investigated the impact of unilateral hearing loss during this time, but studies focused predominately on the impact off amplification—a common theme of the era. This emphasis on technology began to increase as the acceptance of cochlear implantation came to the forefront of research interest in the 1990s.

By the 1990s, the focus on mild or unilateral hearing loss resurged, in part to the implementation of Newborn Hearing Screening protocols. Although children with MB/UHL did not yet have identification referral at this point, several researchers recognized gaps in the literature and began to identify the progress of children with

MB/UHL. These areas of need continued to be identified through the early part of the 2000s. Also, during this time, Bess and Tharpe had again become active in their pursuit of knowledge about MB/UHL, thus serving to be foundational to the literature base in MB/UHL.

Finally, in the 2000's research has begun to truly focus on the impact of the "less deaf." The emphasis for bilateral cochlear implantation for profoundly Deaf children has aided this movement; however, the benefit was not one sided. Although bilateral implant supporters could use literature from unilateral hearing loss research to show the potential for problematic outcomes due to one-sided auditory deprivation, unilateral hearing loss researchers were able to piggy-back on these themes to aid the pursuit of cochlear implantation for unilateral hearing loss. Cochlear implantation for unilateral hearing loss began to increase in 2010 to the present. Since then research on unilateral hearing loss has been evident in both audiological and educational disciplines.

Although research concerning MB/UHL continues to be less prevalent than investigations focusing on severe or profound bilateral hearing losses, the current state of research concerning MB/UHL is gaining awareness. With the constant emphasis on higher standards of student achievement, the recognition of the impact of mild disability on academic progress is finally being recognized. Although it is likely that mild forms of deafness will never be a primary source of research in fields of hearing loss, positive trends in the number of research articles available can be seen. The hope is that within the next 5-10 years, enough can be known about the impact of mild or unilateral hearing loss and the benefits of amplification and access for these children to impact changes in medical and/or educational practice.

Conclusions

According to findings from previous research there exist definite academic and functional risks for children having mild or unilateral hearing loss; however, only the effect, not the cause of the risk has been reported. The group that is most at-risk has not been identified; only the group that displayed academic and functional delays have been investigated, without specific demographics as to who these children are irrespective of their hearing status. The issue at hand now is: “How do we approach this group of children who medically should not have predicted functional difficulties, socially should blend in, and academically should be successful, but are not?” Where do these children with MB/UHL fit into a binary system of Hearing and Deaf, Disabled and Abled, and how can we identify those children who are most at risk to be in the 50% of failing students? The answer lies in identifying the combination of factors that most likely variable to academic and social failure in these students. Using the previous findings on the 5 domains (audiological, quality of life, functional, literacy, and language) researchers have identified areas that are likely to be affected and even some characteristics of those children with MB/UHL who have failed in the past. However, there remain gaps linking this data to application. We understand the impact of hearing loss and certain aspects of demographic risk factors, but how does that inform practice?

Approaching these issues from a marginalization theory perspective, several researchers showed how easily society has relegated this group of individuals into a ‘nonperson' category as human nature tends to classify persons into a binary mode of existence: us and them. Children with MBHL and UHL are neither us, nor them and are therefore neglected in the educational setting—as most powerfully illustrated by Bess and Tharpe (1984) and Schroedel et al. (2003). We can see that children with MB/UHL flow between the three models of disability—sometimes functioning with disability and sometimes functioning without disability, but always functioning in a confused identity of placement. Neither of these approaches addresses the central problem of educational research; beyond the usual conditions that put all children with hearing loss at risk for developmental delay, the protective and risk factors that mediate outcomes in all domains among these children have not yet been delineated (Ross et al., 2008). How do we avoid the neglect of an underserved population that does not fit a binary identity mold, nor the definition of disability so we can identify who is at risk for the problems we've already identified as potential problems?

In conclusion children with mild and unilateral hearing loss are a subgroup of "deaf" or "hearing impaired" students who are eligible for services according to the tenets of IDEA and ADA. However, due to the perceived insignificance of their disability, these children are provided minimal, if any follow-up or monitoring, in their schooling that could identify early problems in their academics, language, or functional ability. Part of the reason for this lack of follow-up or monitoring is that there is no empirical evidence showcasing which students are most at-risk for failure. In order to reduce the detriment in academic and social functioning that these students are experiencing, it is vital that data is provided to aid current teachers and diagnosticians to identify which children are most likely to experience a manifestation of disability that affects their academic and social performance.

CHAPTER III

METHODOLOGY

Introduction

The purpose of this research was to identify any possible commonalities in characteristics that may be useful in aiding current teachers and medical professionals in identifying children with MB/UHL who may be most at risk for academic failure. The study was exploratory in nature and included quantitative research methodology and analysis on both univariate and multivariate dimensions. These dimensions include audiological characteristics; services and supports; parent perceptions/SIFTER ratings; school characteristics; child demographics; and family demographics of students with MB/UHL. The goal of conducting an exploratory study is it provides the foundation of long-term research studies focused on predicting group belonging in order to aid practicing teachers in identifying students with MB/UHL who need close follow-up in order to reduce their risk of academic failure. In order to collect the data, electronic survey distribution was utilized. Analysis of the survey responses included both univariate and multivariate methods were conducted using SPSS 20 for Windows (IBM, 2011).

Primary Research Questions

There is one overarching question for this study, divided into 6 sub-questions that were used as the basis for data collection.

Are there differences between children with mild bilateral and/or unilateral hearing loss who are successful in school and those who fail academically in any of the following areas?

- Audiological
- Early Services and Supports
- Parent Perceptions/ SIFTER ratings
- School Characteristics
- Child Demographics
- Family Demographics

Each of these research sub questions was paired with research-based survey question and data collection methods outlined in the Appendix A: Research Design Logic Model. This model outlines the overarching research questions of the study, areas used to examine these questions, survey questions used to address the overarching question, and the analysis tools/procedures.

Hypotheses

For of the six sub-questions, the hypothesis is the same:

- H_0 = There is no difference between children with MB/UHL who have academic failure and those who have academic success. ($\mu_1 = \mu_2$)
- H_1 = There are differences between children with MBHL who have academic failure and those who have academic success. ($\mu_1 \neq \mu_2$)

Statistical Analysis Methods

Exploration of trends was chosen as the primary goal of the analyses as this research study was aimed at developing a better understanding of the educational outcomes in students with MB/UHL. Using an exploratory design allowed for the identification of future hypotheses for detailed descriptive or causal analyses (Creswell & Clark, 2007). Currently, there exists such limited data on factors contributing to the academic success or failure of children with MB/UHL that an informative analysis can be used to eliminate or identify factors requiring more in-depth analysis than through descriptive or causal analysis in a small *n* study.

Quantitative design was chosen for this study in order to statistically identify any differences that may exist among populations of students with MB/UHL. Analyses were conducted to distinguish common characteristics among students with MB/UHL who are successful in school and those students with MB/UHL who are not successful in school.

Quantitative methodology was chosen for several reasons. First and foremost, the questions of this study were standardized and incorporate the use of scales and categorical values to define parameters of experiences. The goal was not to define the participants' perceptions of hearing loss or concept of hearing loss, but rather to understand characteristics of children that are quantifiable in order to identify possible risks of their academic failure. Lastly, it was a personal goal of the researcher to use quantitative methods as opposed to qualitative methods in order to be able to collect and manage a larger sample size and work towards more generalizable results. Empirical studies of students who are deaf or hard of hearing characteristically incorporate small sample sizes (Martin, 2005). The present investigation allowed exploration into the challenges of conducting research with this low incidence population.

This study integrated both univariate and multivariate methods. In many cases, multivariate analysis is performed with follow up analyses in the form of a univariate analysis. However, in the case of the present study, the univariate analysis better maintained statistical power due to sample size and was therefore used as the primary method of analysis. Multivariate analysis was performed as a follow up to the univariate analysis, with the acknowledgement that power may not be ideally achieved due to difficulty with sampling (Budaev, 2010). Without the full completion of all surveys by participants, the number of participants for all analysis was less than the desired sample size.

Univariate Methods

Univariate analysis explores a single variable in a data set to find ranges of values, central tendency, and patterns with a single variable. Univariate methods, such as descriptive statistics, are often used in multivariate analysis research to provide the researcher with an overview of data trends within a sample such as mean, standard deviation, skew, and kurtosis. For the present study, univariate methods were used as the primary method of analysis. The univariate measurements allowed the researcher to discern trends in individual research questions rather than to document the impact of combined factors. Skew is reported to aid the user in identifying how the data are distributed on a scale. Positive values indicate that data are concentrated more heavily at the left of the scale, zero values indicate centrally concentrated data, and negative skew indicates data that are distributed to the right end of the scale (Figure 7). Likewise, kurtosis aids the user in examining the distribution of data. Kurtosis describes the 'peakiness' of the distribution with negative values indicating flat distributions and positive numbers indicating higher distributions (Figure 8).

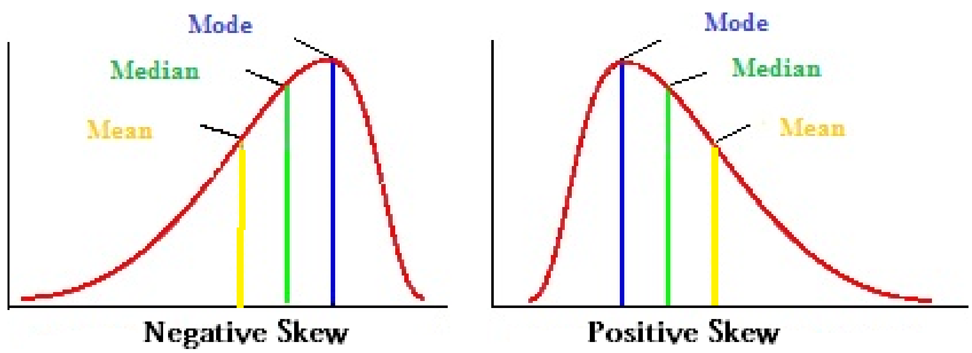


Figure 7. Example of Skew Distribution. This figure illustrates the distributions of non-normal distributions.

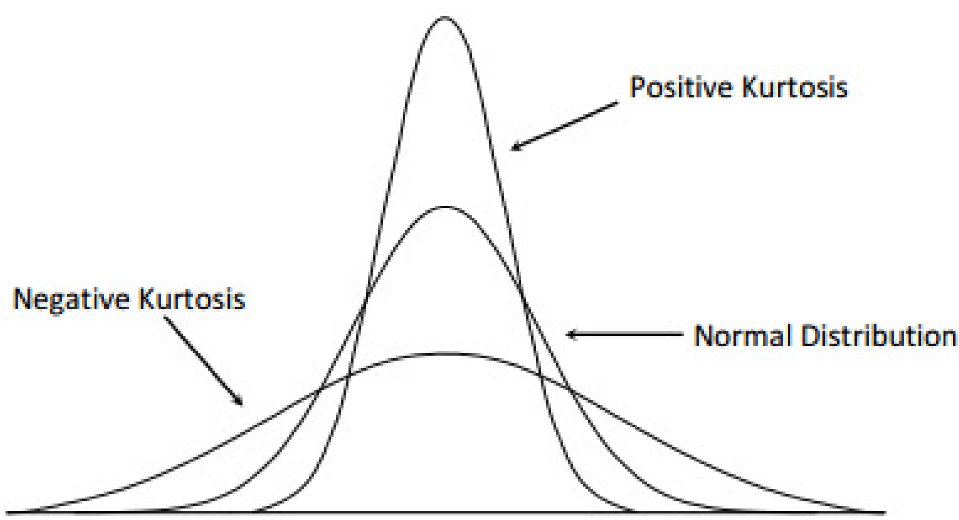


Figure 8. Example of Kurtosis Distribution.

Other descriptive statistics including mean (average) and standard deviation (variation) are included to describe the spread of values, as well as central tendencies for each of the subsets of questions. The use of confidence intervals allows the reader to estimate the likely parameters of the true population, as a sample only provides an estimate to the overall population (APA, 2009). Confidence intervals are included per the recommendation of the American Psychological Association (2009), but are not necessarily required in all fields.

Multivariate Methods

Discriminate analysis was used to describe which variables are best to describe differences between groups (Grimm & Yarnold, 1995). This analysis assumes that groups are independent, variables are multivariate normally distributed, and variance-covariance structures are equal across groups. The goal of using discriminate analysis is to understand which variables contribute strongly to the grouping and which may be irrelevant. With this information, the goal is to create a prediction model with the fewest number of variables necessary so that the minimal number of variables is needed to determine success likelihood.

Justification of Methods

In the case of the current study, the goal was to understand which of the variables within in each set of characteristics (audiological, services, child demographics, family characteristics, SIFTER scores, school factors) best differentiate between the two groups academically successful and academically unsuccessful students with MB/UHL. Secondly, the goal was to examine the six areas of variables (audiological, services, child demographics, family characteristics, SIFTER scores, school factors) to reduce the number of variables needed to be collected in order to aid teachers in identifying at-risk students without complicated measures or lengthy data collection processes. This study aimed to identify which characteristics are important in identifying academic success and academic failure likelihood in students with MB/UHL and to provide teachers with only those variables for examination. The discriminate analysis was conducted through the following steps: (a) defining group belonging, (b) assessing the assumptions of multivariate normality, (c) analysis of the canonical functions (See Appendix E), (d) interpretation of canonical functions.

Group belonging has been determined a priori and must be mutually exclusive, collectively exhaustive, well-defined, and qualitatively different (Grim & Yarnold, 1995). The members of each of the groups must belong to only one group and all members must belong to a group, the groups reflect true differences between entities, and groups can be arbitrarily defined into naturally identified groups. As described earlier, the grouping (academically successful and academically failing) have been defined based on academic progress. Along with the students served on an IEP, grade repetition was the defining characteristics of the unsuccessful category. Students in the successful category had not repeated a grade, nor had they received special education services: however, a 504 Plan for equitable access to academic curricular content was frequently present. The 504 Plan does not indicate academic difficulty as an accessibility contract, unlike the IEP which indicates academic delay.

Following the assignment of group placement, three population assumptions must be met in order to proceed with the analysis; independence, multivariate normality, and homogeneity. Assumption 1, independence of variables, ensures that the variables of one entity are not affected by any other variable. For example, in this study individual audiological frequencies are independent of one another and are included in univariate analysis, but not multivariate analysis. Assumption 2, multivariate normality, assures that variables follow a multivariate normal distribution, each variable is normally distributed and all regression models should be linear. In simpler terms, multivariate normality is the assumption that data is normally distributed with multiple dimensions considered. Assuring these conditions are met prior to analysis can be done through the use of univariate histograms of distribution or Chi-square goodness of fit test. Additionally, the scatter plot of variables shows no relationship. Finally, Assumption 3, homogeneity, checks to ensure the variance-covariance structures are equal.

Next, the discriminate analysis is conducted. In order to determine variables that contribute to group differences, a canonical discriminant function is used. A canonical function is a relationship between linear composites that is used to describe the strength of the relationship (Hair, 1998). The number of canonical function used is based on either the number of groups (k-1) or the number of variables (m), whichever is smaller. For this study, the number of groups (k-1=1) was smaller than the number of variables, so one canonical function was used for all cases.

Because this study has only one canonical variable necessary (k-1), a comparison across canonical function will not occur as this discriminant analysis will result in only one function. The eigenvalues reflect relative importance of the canonical variable in terms of group separation; the larger the value, the more important the canonical analysis is for determining group separation. Next, the p value of the F test is examined. If the p

value is greater than .05, the canonical variable is not interpreted (Hair, 1998). Finally, the percent of contribution can be examined to determine how much of the differences are explained by this analysis.

Finally, when these contributions have been examined, the significant canonical functions are examined. For example, the first canonical variable may be strongly related to a specific variable/trait, as determined by values greater than 0.3 on the structure matrix. This correlation is used to ‘name’ the new variable (canonical function). Consequently, if the canonical function for audiological measures determined that the values of 2000Hz and 8000Hz contribute most to the differences in group, the results might be interpreted and referred to as “High Frequency.” If the results for parent demographics indicate mother’s educational level and mother career choice to have a high correlation, then the variable would be named “Mother Influence.” A guide to understand the discriminant analysis has been provided in Appendix D: Discriminant Analysis.

Research Design

Independent Variables

The purpose of this study was to identify any possible commonalities in characteristics that may be useful in aiding current teachers and medical professionals in identifying children with MB/UHL who may be most at risk for academic failure. The independent variable was defined by two groups based on academic achievement:

- Group 1 (MBHL and UHL, successful)
- Group 2 (MBHL and UHL, failed/at risk and/or passed but receiving special education)

Students who receive specialized education services and/or failed at least one academic grade are considered to be in the “failed” group; all other students are included in the “successful” group, including those students served with specialized education services via an ADA Section 504 plan.

Dependent Variables

Dependent variables related to the areas of audiological data, school structure, SIFTER results, common risk factors, and interventions.

Table 2

Study Factors

Audiological	
• Articulation Index • Sidedness/ Configuration	• Pure Tone Average • Amplification Usage
Services and Supports	
• Age of Identification/Onset • Early Support Services • Amplification • Presence at Birth/ Newborn Hearing Screening	• Etiology • Current Support Services • Follow-Up Frequency • Method of Detection
Parent Perceptions/ SIFTER Ratings	
• SIFTER: • Self-Advocacy	• Academics • Attention • Behavior • Participation • Communication

Table 2

(Cont.)

Parent Perceptions/SIFTER Ratings	
• SIFTER: • Self-Advocacy	• Academics • Attention • Behavior • Participation • Communication
School Characteristics	
• School Size	• Number of Schools Attended
Child and Family Demographics	
• Child: o Gender o Race o Ethnicity o Peer Relationships o Additional Disabilities	• Family: o Household composition o Parent/Guardian educational level o Community Setting o Language

Methods and Materials

Audiological. Using the data entered on the survey by the participants, audiological data including pure tone average, articulation index, and type of hearing loss was calculated. Pure tone average (PTA) was calculated using the average of 500, 1000, 2000, and 4000Hz for each ear. The articulation index (AI) was calculated using the dot method (Mueller & Killion, 1990) which uses audiogram data at 500, 1000, 2000, 4000nd 8000Hz to determine the percentage of audible speech frequencies available to the listener. The AI, specifically the Dot Method was chosen over the Speech Intelligibility Index (SII) because of its simplicity of use (Vermiglio, Soli, Freed, & Fisher, 2012). AI has been calculated electronically through a transformation conducted using Perl Script (See Appendix B) in order to consistently and accurately count the number of dots applicable to each case. Audiological information was analyzed as a combination of the following survey questions: Q88. These questions can be found in the Appendix A.

Services and supports. Interventions attributing to student success were specifically identified from the deaf and hard of hearing research literature presented in Chapter 2. These interventions are specific to hearing loss and include language, amplification, and family dynamics from profound loss research (Yoshinaga-Itano, 2003), as standards for mild and unilateral practices have not yet been developed. Interventions were calculated using the responses to the following survey questions Q14, Q41, Q 80, Q39, Q12, Q59, and Q61.

Parent perceptions/SIFTER ratings. SIFTER scores are calculated on a 5-point Likert scale as prescribed by the author (Anderson, 1989). Each question was compared across participants. Additionally, sub-scales were compared by adding the scores of survey questions R/S 1,2,3; R/S 5,6,7; R/S9,10,11; R/S 14,15,16; and R/S 17,18,19. Overall scores were then calculated. Self-Advocacy scales (Q67, Q68) were also examined. These individual questions were summed to create the SIFTER TOTAL and SIFTERPLUS variables. Anderson (1989) reported reliability of each section of the scale (academics, attention, communication, participation, behavior) to be satisfactory (α = .72-.93). This study indicated good reliability (α = .723).

School structure. School structure information was from parent description of school sized, based on research defined parameters of size (**Table 47**). Additionally, the number of schools attended in each level (preschool, elementary, middle, and high school) were examined. Survey Questions Q44 and Q45 were also used in this analysis.

Child and family demographics. Risk factors identified were derived from Gutman, Sameroff, and Cole's (2003) study on general risk factors associated with grade repetition, as well as Lucio, Hunt, and Bornovalvo's (2012) analyses on school factors attributing to academic failure. Other demographic data collected is based on the National Center for Educational Statistic's (1991) definition of "at-risk" student demographics. Child demographics were calculated using the responses to the following survey questions: Q50, Q48, Q49, Q68, Q69. Family demographics were calculated using the responses to the following survey questions: Q1, Q60, Q9, Q5, Q7, Q8, Q3, Q38.

Hypothesis

Are there similar characteristics in children who have MBHL or UHL that have had academic failure and those who have academic success?

- H_0: There is no difference between children with MB/UHL who have academic failure and those who do not experience academic failure. ($\mu_1 = \mu_2$)
- H_1: There is a difference between children with MB/UHL who have academic failure and those who do not experience academic failure. ($\mu_1 \neq \mu_2$)

- Are there similar audiological factors in children who have MBHL or UHL that have had academic failure and those who have academic success?
    - H_0: There is no audiological difference between children with MB/UHL who have academic failure and those who do not experience academic failure. ($\mu_1 = \mu_2$)
    - H_1: There is an audiological difference between children with MB/UHL who have academic failure and those who do not experience academic failure. ($\mu_1 \neq \mu_2$)
- Are there similarities in services and interventions for children who have MBHL or UHL that have had academic failure and those who have academic success?
    - H_0: There is no difference in identification or intervention between children with MB/UHL who have academic failure and those who do not experience academic failure. ($\mu_1 = \mu_2$)
    - H_1: There is a difference in identification or intervention between children with MB/UHL who have academic failure and those who do not experience academic failure. ($\mu_1 \neq \mu_2$)
- Are there similar parent perceptions/ SIFTER ratings identified by caregivers in children who have MBHL or UHL that have had academic failure and those who have academic success?

- H_0: There is no difference between children with MB/UHL who have academic failure and those who do not experience academic failure as measured across the domains of the SIFTER. ($\mu_1 = \mu_2$)
- H_1: There is a difference between children with MB/UHL who have academic failure and those who do not experience academic failure as measured across the domains of the SIFTER. ($\mu_1 \neq \mu_2$)

- Are there similar schools structures for children who have MBHL or UHL that have had academic failure and those who have academic success?
  - H_0: There is no difference in the school structures attend by children with MB/UHL who have academic failure and those who do not experience academic failure. ($\mu_1 = \mu_2$)
  - H_1: There is a difference in the school structures attend by children with MB/UHL who have academic failure and those who do not experience academic failure. ($\mu_1 \neq \mu_2$)
- Are there similar child demographic characteristics of children who have experienced academic failure as in children who have MBHL or UHL that have had academic success?
  - H_0: There is no difference in child demographic risk factors attributed to children with MB/UHL who have academic failure and their hearing peers. ($\mu_1 = \mu_2$)
  - H_1 : There are differences in risk factors attributed to children with MBHL who have academic failure and their hearing peers. ($\mu_1 \neq \mu_2$)

- Are there similar family demographic characteristics of children who have experienced academic failure as in children who have MBHL or UHL that have had academic success?
    - H_0: There is no difference in family risk factors attributed to children with MB/UHL who have academic failure and their hearing peers. ($\mu_1 = \mu_2$)
    - H_1: There are differences in family risk factors attributed to children with MBHL who have academic failure and their hearing peers. ($\mu_1 \neq \mu_2$)

Pilot Study

Introduction

A two part pilot study was conducted. The first part tested usability and format of data collection tools with a small group. The second component of the pilot study was conducted within the state of North Carolina. Recruitment was conducted using North Carolina hearing loss forums which are publically available, as well as through the distribution of flyers in public locations. In total, 26 respondents began the survey, but only a portion were completed in entirety (n = 13). Several of the respondents (n = 16) provided sufficient information to complete grouping and audiological characteristics.

Phase 1 Pilot Study

The first phase of piloting tested usability and format of data collection tools. Five parents were given copies of audiograms and asked to complete the survey responding to each question in any manner. Each provided feedback on formatting, usability, and user ability to input audiogram details via a phone conversation while completing the survey. Three of the users tested the questions on laptop or desktop computer; two using Windows interfaces, one using Mac interfaces. The other two participants used smart devices; one a Droid phone and one an iPad. Only the Droid user reported difficulty with survey functioning. Adjustments were made to formatting and the user was able to successfully complete the survey. Participants completed the audiogram input with 98.3% accuracy. This was calculated by the total of correct input of 12 points each (59) divided by total points (60).The only error came from the use of arrow keys to scroll, which in turn adjusted points that were inputted using mouse correctly. The keyboard feature was disabled, with the ability to override this limitation for handicap accessibility. Eight typographical errors were corrected; gender statuses for children were questions but remained inclusive to transgendered populations, marital status were adjusted to account for partnerships as well as legal marriages. Preliminary audiological results were transformed from survey format to clickable. Calculations of AI calculated through the Pearl Script were cross-checked with 100% accuracy in transformation.

Phase 2 Pilot Study

The second component of the pilot study was conducted within the state of North Carolina. Recruitment was conducted using North Carolina hearing loss forums which are publically available, as well as through the distribution of flyers in public locations. In total 75 flyers were distributed in 8 counties within North Carolina. Venues included public announcement boards in libraries, restaurants, and shopping centers. In total, 26 respondents began the survey, but only a portion were completed in entirety (n = 13). Several of the respondents (n = 16) provided sufficient information to complete grouping and audiological characteristics. The greatest amount of attrition occurred after the third questions which asked parents if they had an audiogram of their child. This question cannot be eliminated, as it is the primary identification source for classification of student hearing loss.

Pilot Study Analysis

Because of the limited number of participants, a full multivariate analysis of the data could not be conducted during the pilot phase. Sub-groups of data were analyzed for trends in group, group prediction (later dropped), and univariate descriptive statistics. Analysis was conducted using SPSS for Windows (IBM, 2011). Additionally, cross-tabs and univariate calculations were run using SPSS (IBM, 2011). Five groups; audiological information (left ear audiogram, right ear audiogram, right ear audiogram, general audiogram characteristics, SIFTER survey, child and family risk factors, identification factors, and school experiences. For all results, Group A/1 (first listed) will refer to successful students and Group B/2 (second listed) to failing students, as defined previously. Power was very weak due to the sample size.

Univariate results. When examining the results from univariate tests of mean differences within the pilot study, no significant differences were observed in factors related to the right ear, amplification usage, school setting, and family risk factors between groups. However, significant differences were observed in several factors within the remaining categories. In the left ear audiological significant differences were observed at 250Hz, 2000Hz, 4000Hz, and 8000Hz. This likely influences the significant differences observed in the overall audiological differences where the Left PTA showed lower pure tone hearing thresholds for students who were not successful. Child risk factors showed that the presence of additional disabilities to be present significantly more in students who were not successful than those who were successful. Parent ratings on the SIFTER indicate significant differences in overall Academics and overall Communication, particularly on the ratings for academic growth, vocabulary, and ability to assimilate new information. Finally, significant differences were noted in detection methods and age between groups.

Multivariate results. Multivariate analysis could not be conducted during the pilot phase due to the small sample size.

Conclusion of Pilot Study

Through the piloting phases, modifications were made for usability by participants and accuracy of input. Several questions from the pilot study were modified and deleted (See Appendix A Put in the name of the document in Appendix A). Based on the attrition patterns, questions were reordered to ensure that a majority of the questions were completed prior to the likely question for participation cessation. Although the questions that tended to see attrition were not critical to the success of the survey, they were determined to be important to the study and therefore were not removed from the question queue. Additionally, a progress through survey bar was added to encourage participants in completing the survey.

Setting and Participants for Full-Study

Recruitment was conducted through using convenience sampling method using online distributions to interest groups (teachers of students who are deaf or hard of hearing, audiologists, parent support groups) and public information boards (i.e., libraries, community announcements) to contact participants. Using G-Power (Faul, Erdfelder, Lang, & Buchner, 2007; Schnlau, Fricker, and Marc, 2002), it was determined that for the MANOVA tests to achieve a medium effect size of 0.5, power .80 with $\alpha = .05$, 128 participants would be necessary. For risk of attrition, incomplete data, and disqualifying degree of hearing loss, a goal of a minimum of 150 participants was set to be surveyed.

Surveys were conducted online through Qualtrics Survey Software (Qualtrics, 2005-2015). Surveys were distributed to target US participants only using social media and public bulletin boards. Due to the nature of social media, participants in countries outside the US may have also been exposed to the invitation to participate. Internet Protocol (IP) addresses were collected to ensure that responses came from within the US and were not automatically generated computer responses. Those who participated in the survey, but were not from the U.S. or its territories were not included in the analysis. Participants were parents/guardians of children with MB/UHL who were in K-12, public school settings. Survey collection occurred over the period of 6 months. A total of 283 surveys were attempted. Of these, 249 surveys were determined to be valid for inclusion based on location, the ability to confirm hearing loss criteria and/or percentage of completion being more than 50%. Among these cases, 212 were identified as having optimally complete audiological data and child demographic information. Only 31 surveys were completed in entirety.

Instrumentation

The online survey was composed using Qualtrics Survey Software (Qualtrics, 2005-2015). The instrument has two sections; research questions extracted from previous studies and the SIFTER. The first section of the survey consisted of demographic information used to obtain an overview of student characteristics by gender, socioeconomic status, familial status, and early educational services. These factors were identified in several research studies focusing on general education students as characteristics that are more highly associated with students who fail academically or drop out of school (Jimerson, 2000; Malinauskine, 2011; NELS, 1988).

Secondly, the SIFTER (Screening Instrument for Targeting Educational Risk), a validated survey tool designed specifically to identify risk factors among students with hearing loss, was included to obtain information regarding perceived progress academically, linguistically, socially, behaviorally, and in attention (Anderson, 1989). These domains were identified as areas that children with hearing loss tend to exhibit the impact of hearing loss on their communication disabilities. The SIFTER is a 15 question five-point Likert scale which asks parents to rate their child in five areas; academics, attention, communication, participation in classroom activities, and behavior. Children can pass or fail on any section of the survey to be considered 'at risk' academically with a score less than 7. The sum score of each of these sections is then summed to give an overall SIFTER rating, which has no cut-off for pass or fail.

The survey was pilot tested with a volunteer group of parents (n = 8) of parents with deaf children to test clarity, accuracy, and ease of completing the survey. Half

(n = 4) of the users participated via traditional computer access, half (n = 4) used smart phone or tablet access. Pilot users were given sample audiological data to enter so that their personal children's information was not included. Additionally, pilot testing participants were instructed to answer questions, but true responses were not encouraged as this was not a collection of information, but a test of functionality of survey items. Feedback on questions and designs was collected and changes to the formatting of the questions and response choices were made based on the pilot testing participants' input.

Data Processing

Upon approval of the Internal Review Board at the University of North Carolina (UNCG-IRB) at Greensboro, recruitment literature was distributed via multiple venues. Flyers were posted in public Internet forums related to hearing loss, public announcement boards, public websites advertising research studies, and social-media sites. Flyers were also distributed using hearing loss-focused list serves (Appendix D: Institutional Review Board Documentation).

Participants completed a series of online-survey questions about their children with mild or unilateral hearing loss. Survey data was collected through a secure server using Qualtrics Survey Software, hosted at the University of North Carolina at Greensboro. Downloaded data used for analysis purpose was maintained on a double-password protected server, as mandated by UNCG-IRB. Data was transformed using a Perl Script (See Appendix B) for two variables: audiogram and Articulation Index. This transformation was necessary to extract full audiological data and calculate Articulation Indexes from given input as Qualtrics Survey Software does not have such functions.

Data was analyzed using SPSS for Windows (IBM, 2011). Subsets were analyzed according to the research design logic (see Appendix A: Research design logic matrix) and then as an entire set of variables. Univariate means were also examined using SPSS for Windows (IBM, 2011) in order to examine any trends.

Ethical Considerations

Precautions were taken to ensure that risk to participants was minimalized according to the outline of the American Psychological Association (APA) and the University of North Carolina Internal Review Board (Appendix C). Risks were defined to be minimal, if any, per IRB protocol. Subjects were informed of minimal risks and the efforts to reduce those risks. Participants were completely informed concerning the nature of the potential risk (emotional, confidentiality) and contacts for support should problems arise were provided. Permission for participation in the study was acquired in writing through an electronic submission from the subjects themselves. Copies of the participant waiver were made available in hard copy to participants using an internal link on the Qualtrics survey software. No participants were below the age of consent.

The data collected about students is strictly confidential and kept in a secure location, per IRB protocol. Individual scores will never be reported, nor made public. To reduce the risk to confidentiality, all data was stored electronically in a double password encrypted virtual site. Internet Protocol (IP) numbers were stored separately in a coded-file for use only if a participant wished to withdraw his or her responses. Identifiable information (IP address) was excluded from the survey to prevent possible participant and student identification. Paper copies and digital copies will continue to be kept in a central location under lock and key. Data will be destroyed 3 years after the completion of this study.

Validity Considerations

Internal Validity

Internal validity is the extent to which the independent variables cause an effect on the dependent variable. As the design for this study is descriptive and exploratory in nature, the concern for causation is lessened, however still considered. Seven areas need to be considered for internal validity: subject variability, size of subject population, time given for data collection, history, attrition, maturation, and instrumentation (Seliger & Shohamy, 1989).

Within-subject variability was not considered as this study was not an experimental design, but it was an exploratory design. Sample size was determined using G*Power (Faul et al., 2007), requiring at least 132 participants to maintain power. Minimal sample size was set at 150 to accommodate for attrition and non-fit. A greater number could have been set, but the nature of childhood deafness does not necessarily lend itself to large N studies without access to large hospital or clinic datasets.

Threats to internal validity, such as instrumentation, selection bias, and experimenter effects were reduced to the best of the researcher's ability through piloting. Instrumentation was piloted in multiple settings including two-stages of testing: one with parents who did not fit the category, but who could provide feedback on clarity, ease of use, and problematic features of accessibility; one with a random population of participants who responded to flyers posted. Group assignment in this study was not random as in an experimental design, so selection bias was less of a concern. Participation bias is a factor in this study, as recruitment is voluntary in basis and participation requires access to an online survey conducted in English. Experimenter effect was eliminated through the issuing of survey questions without the presence of the researcher during survey completion.

External Validity

External validity is the extent to which the study is generalizable to the general population. Seven areas must be considered when planning for external validity: population characteristics, interactions of subject selection and research, descriptive explicitness of independent variable, effect of research environment, research effects, data collection methods, and effect of time (Seliger & Shohamy, 1989).

Population characteristics are potentially generalizable as participants were not selected from one specific geographic or cultural region within the United States. Children were similar in this study to the U.S. population (Federal Interagency Forum on Child and Family Statistics, 2014). Population generalizability outside of the United States would need to be considered as different countries define mild and unilateral hearing loss differently in terms of impact of disability. Interaction of subject selection and research was not considered as the study was not an experimental design. Independent variables were specifically defined in the methodology of the design. Participants were grouped into two categories: successful (having no academic failure, retention, nor academic intervention needs) and unsuccessful (having at least one grade retention due to lack-of-progress, and/or receiving specialized education services for academic purposes.)

Several areas of generalization were considered when examining external validity including generalizations across settings/context and generalizations across time. Additionally, subjects were not randomly assigned to group belonging, but assigned following specific criterion. Participants joined the study on a voluntary basis as recruited by outside influences such as teachers, medical professionals, and social media. Contextually, the pilot study was conducted in a single, Southern US state, displaying bias towards a specific demographic as well as a specific intervention protocol. The full-study was conducted on a national scale and allowed for more generalizability. The environment for the study was an online atmosphere. This increased the risk of under-representation to poor and rural participants as well as to participants who religiously avoid technology. Some limitations in generalizability were confirmed due to sample of participants who voluntarily answered the call for survey participation.

Summary

In summary, this quantitative survey study employed survey methods to collect demographic information on children with mild and unilateral hearing loss across the United States. Methodology was established in a manner that allowed for parents to describe their child without identification. Using descriptive analysis, such as normality of distribution, data was analyzed to identify and predict patterns in grouping to aid in service provision and intervention. Chapter IV will analyze the results of the study.

CHAPTER IV

RESULTS

Introduction

The purpose of this study was to understand characteristics of children who have mild bilateral or unilateral hearing loss (MB/UHL) who are successful in school compared with their peers who struggle academically. In previous studies the prevalence of such children in school settings, as well as their academic success/failure rates; have been identified however, no investigation has been conducted to identify how children with MB/UHL who are academically successful differ from children with MB/UHL who fail academically. Many of these characteristics have been identified in children with severe or profound hearing loss, but few studies have examined children with the lesser degree of hearing loss. If differentiating characteristics emerge, the hope is that these can be used to target specific children for early intervention or early educational services and prevent their academic failure by providing preventative rather than reactive interventions.

The analysis that follows utilizes the analysis of factors that have been identified in previous studies as risk factors for academic failure in hearing and significantly deaf populations. Such factors include: audiological, demographic, school/educational, familial, and medical characteristics. The goal of the current study is to examine if there are differences between successful and failing students with MB/UHL that might need to be addressed by medical or academic agencies in order to prevent such a large percentage of students within this group from failing academically.

This chapter presents a summary of the participants, their demographics, and a short description of the sampling process. A summary of the analyses conducted on each univariate variable and multivariate results follows. Audiological data is presented first, followed by the type of past/ present intervention services the children received. Third, the results from the administration of a SIFTER survey examining academics, attention, communication, participation, behavior, and self-advocacy is described. School factors are described. Lastly, child characteristics (both intrinsic and familial) are presented.

Description of Sample

A total of 283 surveys were started, 249 were able to be confirmed as valid cases for this study through audiological data and geographical (US) status. Surveys with less than 50% completion were not considered valid and were not used. The 249 valid cases were used in this study, however only 31 surveys had 100% completion. Respondents who did not respond to all questions were still included, but their unanswered questions were ignored in the analysis. Of the 249 surveys, mothers completed 66% surveys, fathers completed 14% of surveys, other family members or guardians completed the remaining 20% of surveys. Participants were located throughout the US, US territories, and US military bases (see Table **3**). Students with mild bilateral hearing loss accounted for 32% of the participants, children with right unilateral hearing loss accounted for 31%, and children with left unilateral hearing loss accounted for 29% of participants. In total, 72% of students were successful academically and 29% failed academically, indicating slightly fewer failing students than in previous studies, which indicated 35-50% failure rates (Bess & Tharpe, 1986).

Table 3

Location of Participants

Location	Frequency	Percent
Alaska	2	1%
Arkansas	1	0%
California	1	0%
Colorado	1	0%
Florida	2	1%
Illinois	1	0%
Kansas	1	0%
Kentucky	1	0%
Maine	2	1%
Minnesota	6	2%
Mississippi	1	0%
Montana	1	0%
New York	5	2%
New Jersey	1	0%
North Carolina	5	2%
North Dakota	1	0%
Ohio	1	0%
Oklahoma	2	1%
Pennsylvania	3	1%
South Carolina	1	0%
Texas	2	1%
Wisconsin	2	1%
US confirmed by IP address, including military	201	81%
US Territory (Guam, Puerto Rico, America Samoa, Virgin Islands, Northern Mariana Islands)	2	1%
Washington, D.C	3	1%
Total	249	100%

Survey recruitment was conducted through the use of social media and using flyers throughout publically accessible boards within the U.S. for snow-ball effect recruitment. More than half of the participants (55%) accessed the survey through the distribution of flyers and business cards containing access information. Facebook mobile (18%) and Facebook (14%) accounted for the largest portion of social media recruitment. Other social media (Social Search, Reddit, LinkedIn, Google+, and Twitter) resources accounted for the remaining 14% of the participation. Recruitment was tracked through Google Analytics.

Statement of Results

The hypothesis for each research question was the same:

- H_0 = There is no differences in characteristics of children with MB/UHL who have academic failure and those who have academic success. ($\mu_1 = \mu_2$)
- H_1 = There are differences in characteristics of children with MB/UHL who have academic failure and those who have academic success. ($\mu_1 \neq \mu_2$)

In each group of variables, the null hypothesis was rejected at the univariate level for some of the characteristics. Table 4 provides a summary of characteristics that were significant and not at the univariate level. Further details about each factor will be described later. As a unit, using multivariate analysis, only school characteristics, SIFTER perceptions, and child demographics were significant.

Table 4

Summary of Univariate Results

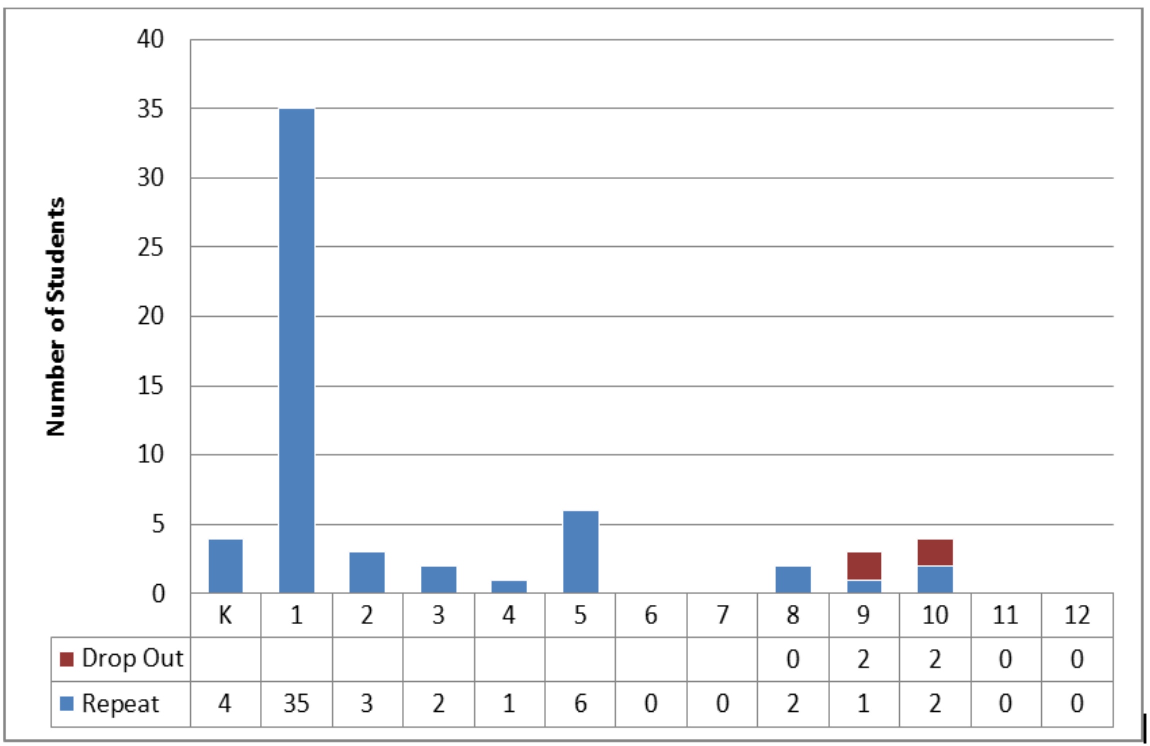
	Significant	**Non-Significant**
Audiological Characteristics	Left ear at 250,1000,4000 Hz Articulation Index (Left) PTA (Left)	Left Ear at 500, 2000, 8000Hz Right Ear at 250, 500, 1000, 2000, 4000,8000Hz AI (Right) PTA (Right)
School Characteristics**	Size of Elementary and Middle School	Number of Schools Size of Pre-K, High School
Parent Perceptions/ SIFTER**	Academic Achievement Communication Ability Child Behavior	Attention Ability Child Participation Self-Advocacy SIFTER Total SIFTER Plus
Services and Supports	Etiology Early Services Provided (*Early Intervention, Special Education, Classroom Modifications*) Current Services Provided (*Special Education, Classroom Modifications*) Amplification (*Past and Present Personal and Classroom*)	Age of Onset Early Services Provided Current Services Provided Presence at Birth Method of Detection Follow-up Frequency
Child Demographics**	Additional Disability Ethnicity	Race Gender
Family Demographics	Mother Educational Level Secondary Language	Father Educational Level Family Size Community Type Family Status/Composition Primary Language Income

***Indicates Multivariate Significance.*

Details of Analysis

Grade Repetition Tendencies

Of the 249 valid respondents, 56 grade repetitions and four high school drop outs were reported, as detailed in Figure **9**. The largest concentration of school repetition occurred in first grade, accounting for 59% of the total grade repetitions. Kindergarten and second grade also contributed highly to the concentration of grade repetition in the primary grades, accounting for 13% of the overall grade repetitions. In addition, fifth grade represented 11% of grade repetitions. This concentration parallels the pattern for early grade repetition among typical students (Silverstein, Guppy, Young, & Augustyn, 2009); however, the percentage of students repeating a grade was higher than typical children for students with mild bilateral or unilateral hearing losses. For example, the rate of retention in 2007 for grades 1-3 nationally was 4.5% (Bank, 2013), but 16% for participants of this study. Additionally, the pattern of fifth grade repetition for children with MB/UHL was atypical compare to typically developing children (Banks, 2013).



	K	1	2	3	4	5	6	7	8	9	10	11	12
Drop Out									0	2	2	0	0
Repeat	4	35	3	2	1	6	0	0	2	1	2	0	0

Figure 9. Number of Students Repeating or Dropping out by Grade. The chart illustrates the grade level of failed grade level or school dropout among participants.

Six students (11%) repeated more than one grade (Table 12), a disturbing statistic knowing that children who are retained are more likely to dropout (Jimerson, Anderson, & Whipple, 2002). In the current study, all students who dropped out had failed at least one grade. Dropouts were reported in ninth and tenth grades, which indicates that students with mild or unilateral hearing loss who drop out, drop out sooner than their fully-hearing peers who tend to drop in 11th and 12th grade (Center for Business and Economic Research, 2009). Three of the four students who later dropped out had repeated two grades. Two of the four students who dropped out of high school received special education services.

Audiogram Results

To determine if there were differences between audiological factors, descriptive statistics and independent *t*-tests were conducted on individual audiological variables. A discriminate analysis was conducted on all variables as a set. Descriptive statistics were calculated on all audiological variables (each frequency of audiogram, pure tone averages, amplification usage, and medical follow-up). *T*-tests were conducted on the subset of audiological factors specifically related to the audiogram output (hearing levels, pure tone average, and articulation index). A discriminant analysis was conducted using audiogram variables and service/intervention variables. Table 5 provides a summary of each variable and the results; further description of each difference can be found within the text that follows.

Table 5

Audiological Factor Summary

Variable	Variable Type	Analysis	N	Results	Significant
Question: Q88		Please enter your child's most recent audiogram into the field below.			
Variable	**Variable Type**	**Analysis**	**N**	**Results**	**Significant**
Right 250 Hz	Continuous	*t*-test	212	$t(210)=-0.73$, $p=.467$, 95%CI [-6.20, 2.86], $r=.05$	
Right 500 Hz	Continuous	*t*-test	212	$t(210)=-1.27$, $p=.205$, 95%CI [-7.97, 1.72], $r=.09$	
Right 1000 Hz	Continuous	*t*-test	212	$t(210)=-1.38$, $p=.169$, 95%CI [-8.13, 1.43], $r=.10$	
Right 2000 Hz	Continuous	*t*-test	212	$t(210)=-1.50$, $p=.136$, 95%CI [-9.44, 1.29], $r=.10$	
Right 4000 Hz	Continuous	*t*-test	212	$t(210)=-1.43$, $p=.155$, 95%CI [-9.55, 1.53], $r=.10$	
Right 8000 Hz	Continuous	*t*-test	212	$t(210)=0.32$, $p=.752$, 95%CI [-4.58, 6.33], $r=.02$	
Question: Q88		Please enter your child's most recent audiogram into the field below.			
Variable	**Variable Type**	**Analysis**	**N**	**Results**	**Significant**
Left 250 Hz	Continuous	*t*-test	211	$t(209)=-1.82$, $p=.07$, 95%CI [-8.59, 0.34], $r=.13$	Yes
Left 500 Hz	Continuous	*t*-test	211	$t(70.03)=-1.90$, $p=.062$, 95%CI [-11.55, 0.29], $r=.22$	
Left 1000 Hz	Continuous	*t*-test	211	$t(209)=-2.04$, $p=.042$, 95%CI [-11.19, -0.20], $r=.14$	Yes
Left 2000 Hz	Continuous	*t*-test	211	$t(72.43)=-1.93$, $p=.058$, 95%CI [-13.07, 0.22], $r=.22$	
Left 4000 Hz	Continuous	*t*-test	211	$t(-79.08)=-2.07$, $p=.042$, 95%CI [-13.32, -0.26], $r=.23$	Yes
Left 8000 Hz	Continuous	*t*-test	211	$t(65.47)=-0.34$, $p=.735$, 95%CI [-8.89, 6.31], $r=.04$	
Question: Q88 (extracted)		Please enter your child's most recent audiogram into the field below. (Extracted from audiogram input)			
Variable	**Variable Type**	**Analysis**	**N**	**Results**	**Significant**
Right PTA	Continuous	*t*-test	212	$t(80.29)=-1.43$, $p=.157$, 95%CI [-8.71, 1.43], $r=.16$	Yes
Left PTA	Continuous	*t*-test	211	$t(73.87)=-2.10$, $p=.039$, 95%CI [-11.96, -0.31], $r=.24$	Yes
Right AI	Continuous	*t*-test	212	$t(75.33)=1.91$, $p=.059$, 95%CI [-0.37, 18.21], $r=.22$	Yes
Left AI	Continuous	*t*-test	211	$t(71.72)=2.70$, $p=.009$, 95%CI [3.27, 21.66], $r=.30$	Yes
Audiological Factors	Multivariate	Discriminant Analysis	212	$\Lambda=0.90$, $\chi^2=20.78$, $df=14$, Canonical Correlation=0.31, $p=.107$	

Audiogram output.

Left ear audiogram. On average, participants in the successful group had hearing ranges that where higher than those who failed academically in all frequencies in the left ear (Table 13). Data distribution was positively skewed as expected. Positive skew is reflective of the distribution of responses in the mild range and was observed across all frequencies in the left ear of successful students. Negative skew (-1.13) was observed at 8000Hz in students who had failed, indicating a density of greater hearing loss in this frequency.

At all frequencies, the mean value (Figure 10) fell above the level needed to perceive speech; however as heat density plots illustrate (Figure 11 and Figure 12), children in the failed group had a larger representation of students who had greater degrees of hearing loss outside of ranges needed for speech reception. The greatest difference in mean hearing loss (see Table 14) was observed at 2000Hz (6.42dB) and 4000Hz (6.79dB), frequencies that are known to have high association with the auditory perception of speech sounds, in particular consonants. In both cases, the greatest density fell within the “mild” range (average 16-40dB).

Significant differences in mean hearing levels (See Table 5 and Table 14) observed at 250 Hz ($t(210)=-0.73$, $p=.0467$, 95% CI [-6.20, 2.86] with a small effect size ($r=0.05$);1000Hz, $t(209)=-2.04$, $p=.042$, 95% CI [-11.19,-0.20], with a small effect size ($r=0.14$); and at 4000Hz, $t(79.03)=-2.07$, $p=.042$, 95% CI [-13.32,-0.26], with a small effect size(r=0.23). The hypothesis that the groups are equal audiologically is rejected for the left ear.

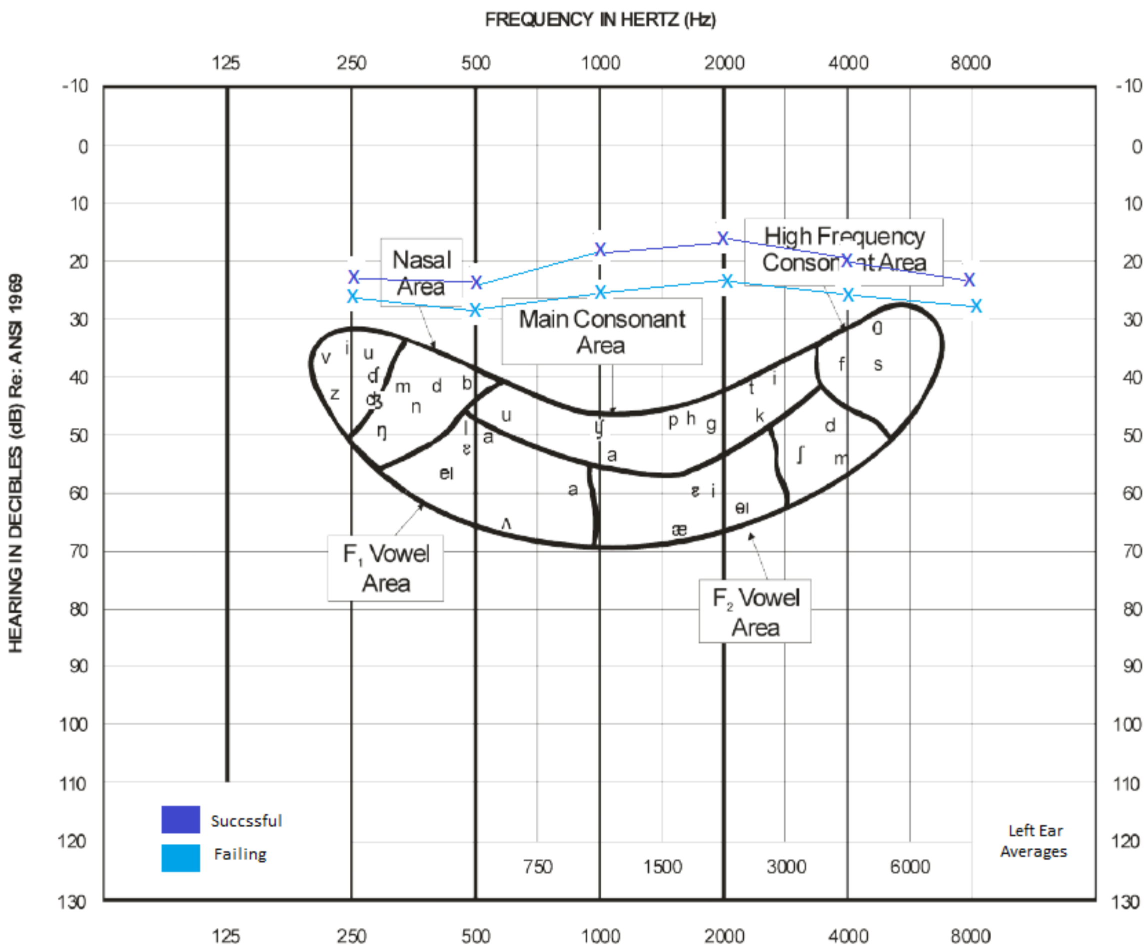


Figure 10. Left Audiogram Averages. The figure plots the difference between mean hearing levels for each group in the left ear.

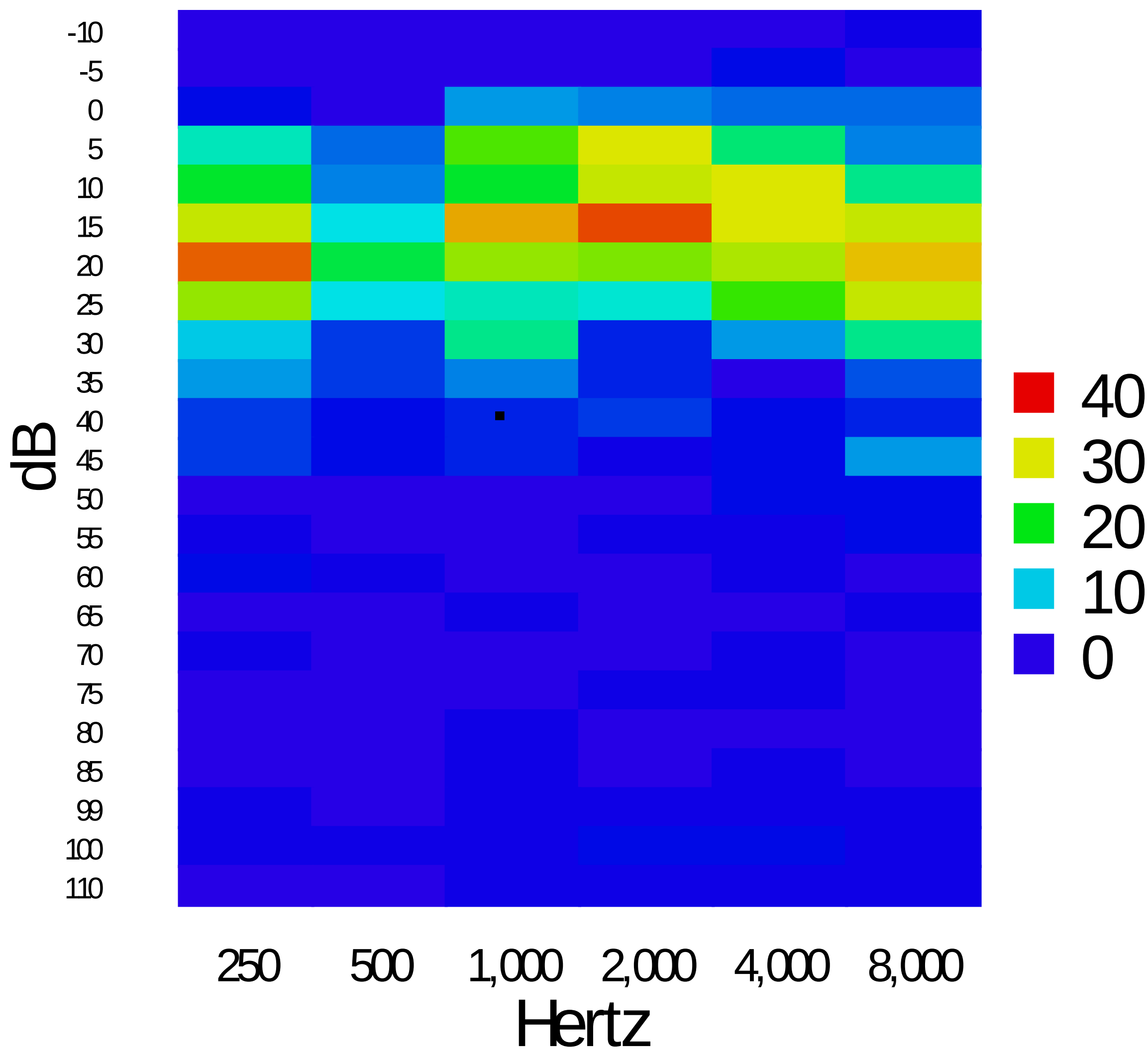


Figure 11. Heat Density of Left Ear for Successful Students. This figure illustrates the number of successful students with each degree of hearing loss by frequency in the left ear.

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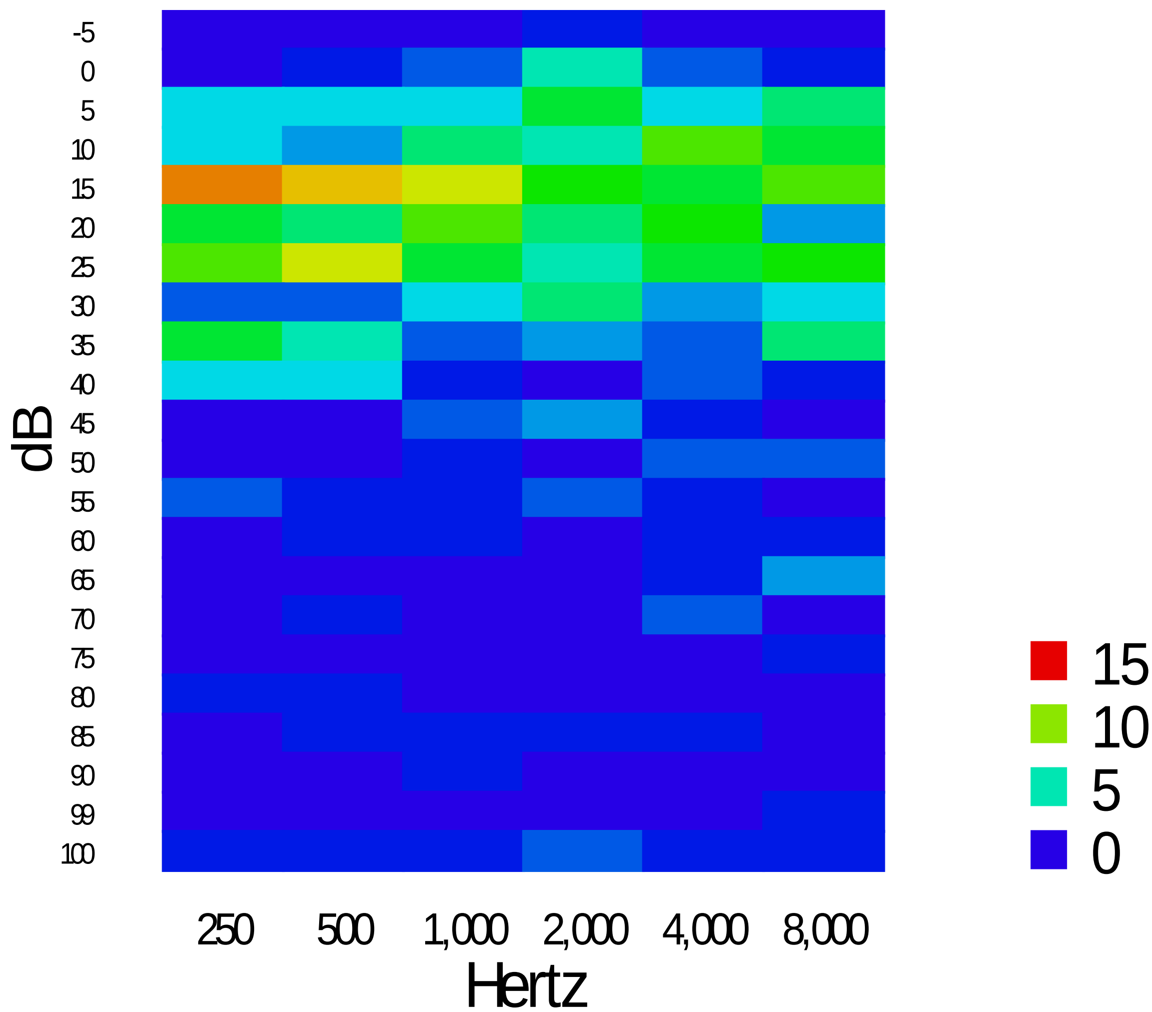


Figure 12. Heat Density for Left Ear for Failing Students. This figure illustrates the number of failing students with each degree of hearing loss by frequency in the left ear.

Right ear audiogram. Similar to the audiological results for the left ear, students in the successful group had hearing ranges in the right ear that were less diminished than those of students who failed academically in all frequencies, with the exception of 8000Hz (Table 15). Positive skew indicates tendency to concentrate around the lesser degrees of hearing loss. This positive skew is expected as it is the nature of mild degrees of hearing loss. The differences between groups were not significance at any frequency for the right ear (see Table 16). In all cases, the mean value (Figure 15) fell above those frequencies needed to perceive speech; however like the left ear, children in the failure group had a larger representation of greater degrees of hearing loss, beyond that is needed for speech reception (Figure 13 and Figure 14). Greatest differences were observed at 2000Hz (-4.07dB) and at 4000Hz (-4dB). The hypothesis that groups are equal audiologically is accepted for the right ear, as no variables were significant.

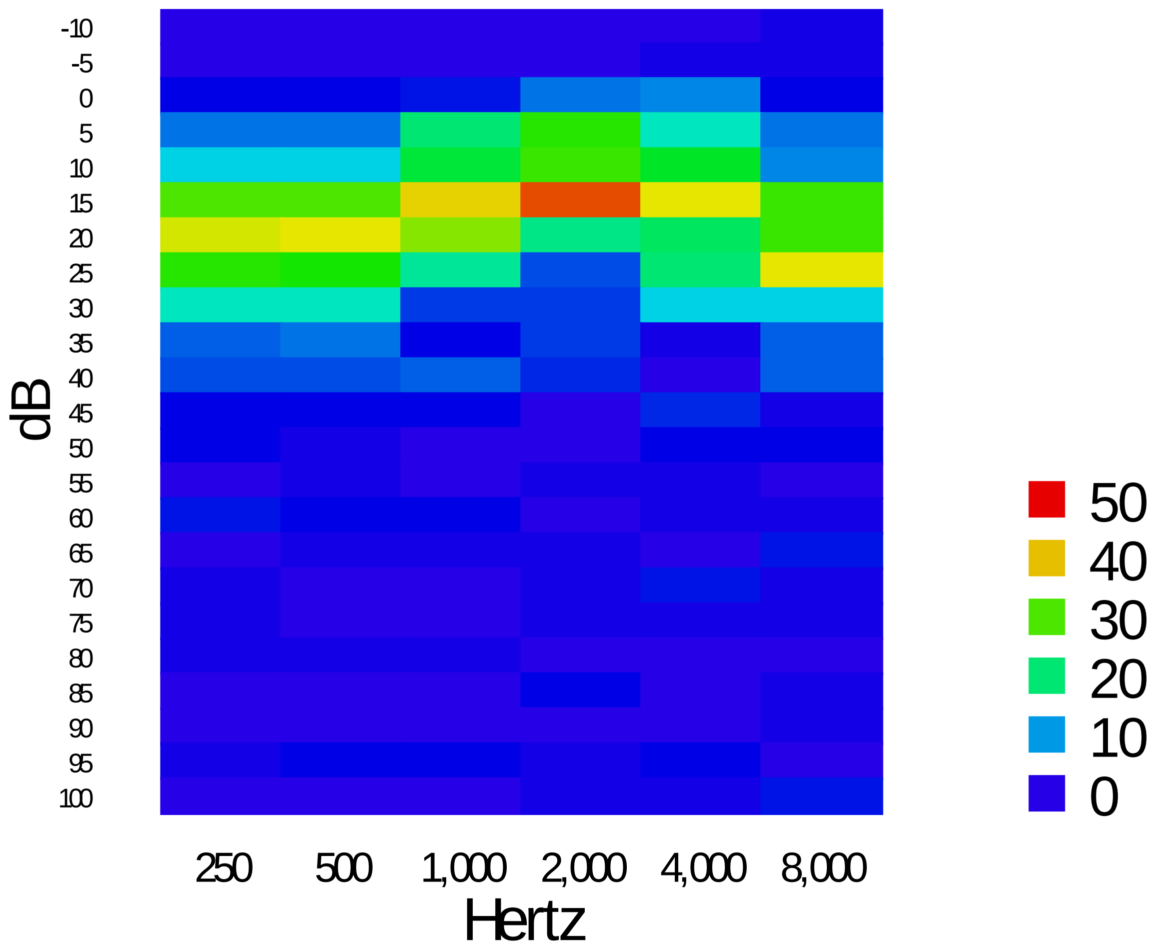


Figure 13. Heat Density for Right Ear for Successful Students. This figure illustrates the number of successful students with each degree of hearing loss by frequency in the right ear.

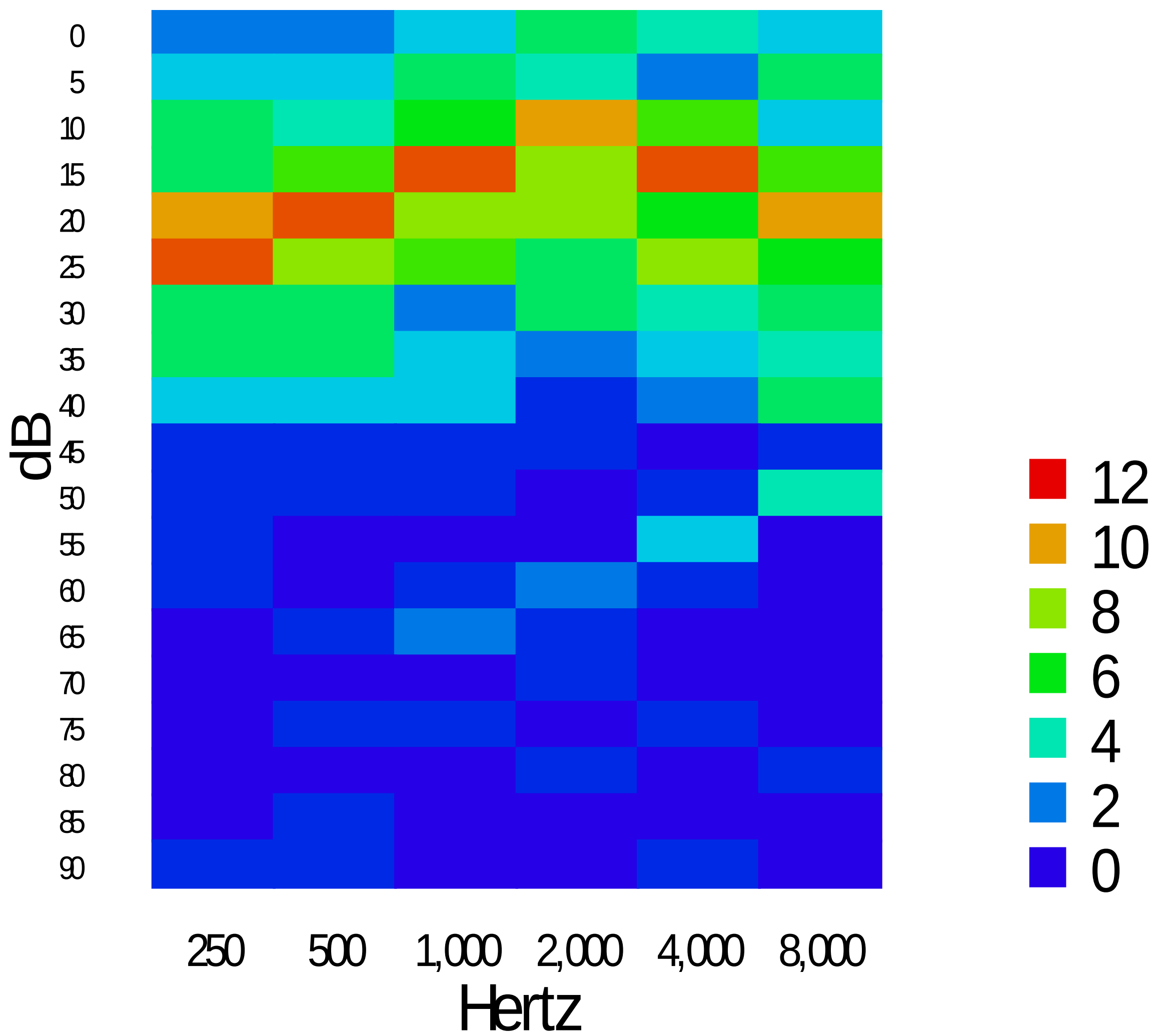


Figure 14. Heat Density for Right Ear for Failing Students. This figure illustrates the number of failing students with each degree of hearing loss by frequency in the right ear.

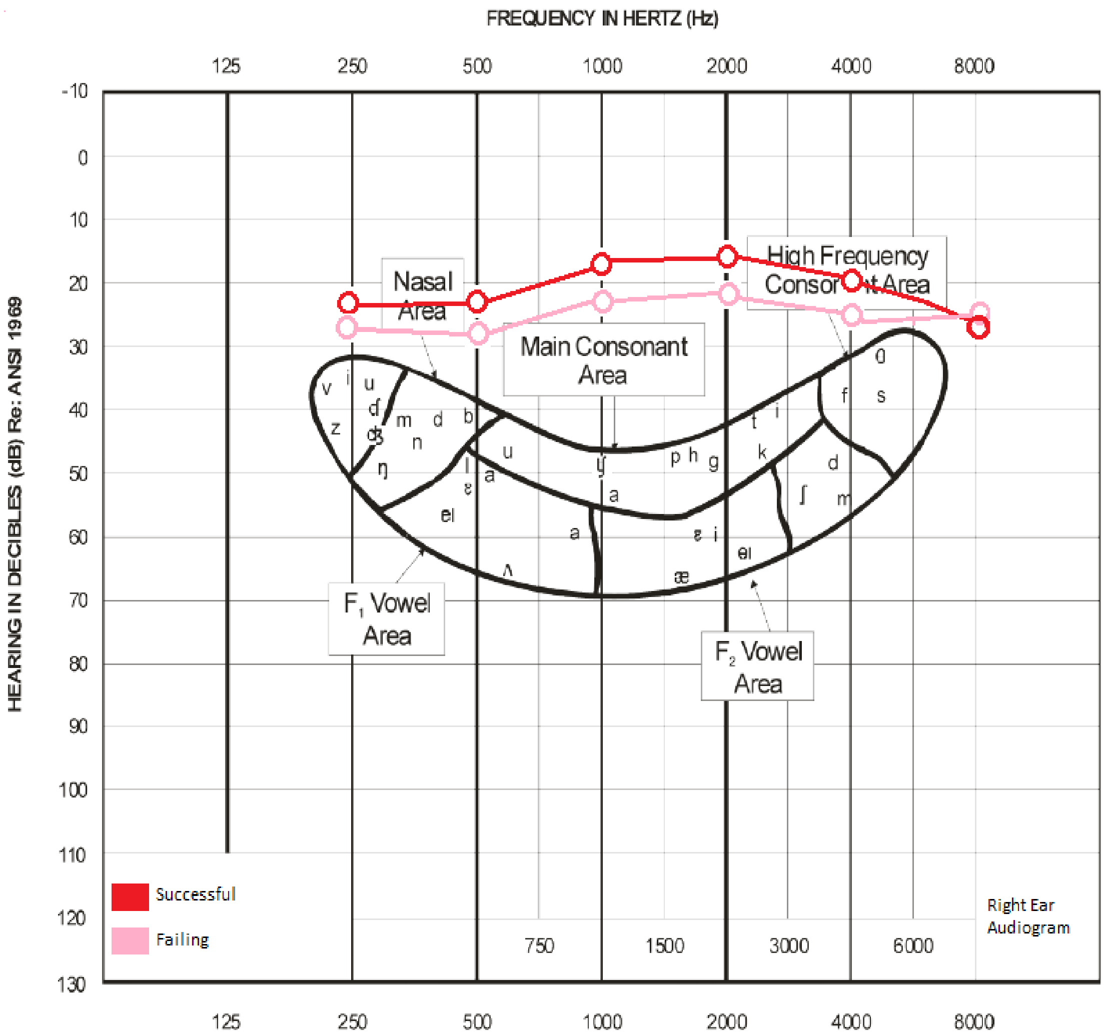


Figure 15. Right Audiogram Averages. This figure compares the mean level of hearing loss for successful and failing students.

Pure tone average and articulation index. Consistent with the examination of ear sidedness, students in the academically successful group had pure tone averages (PTA) that were less diminished than those who failed academically (Table 17). The differences, described in Table 18, were significant for left PTA, $t(73.87)=-2.10$, $p=.039$, 95% CI[-11.96,-0.31], with a small effect size($r=0.24$); but not right PTA, $t(80.29)=-1.43$, $p=.157$, 95% CI[-8.71,1.43], with a small effect size($r=0.16$). In all cases, mean PTA fell above those frequencies needed to perceive speech, however as PTA is a measurement of average across multiple frequencies, it is important to remember that not all students in this study have hearing in all frequencies within the range of speech reception.

Although pure tone averages and individual frequency suggests that the students were able to access speech through audition, Articulation Index (AI) results indicate otherwise. Average AI for both successful and failure groups indicates ratings less than a perfect 100, that is representative of speech frequencies that are inaccessible. For successful students, these means (85.68 and 84.14) indicate an average loss of 14% of speech sounds for the left ear and 16% of speech sounds in the right ear for successful students. For failing students the mean (73.13 and 75.26) indicates an average loss of 27% of speech sounds in the left and 25% in the right ear. These differences were significant for the Left AI, $t(71.72)=2.702$, $p=.009$, 95% CI [3.27, 21.66], with a medium effect size($r=.304$); but not the Right AI, $t(75.33)=1.913$ $p=.059$, 95% CI [-0.366, 18.214], with a small effect size ($r=0.22$). It is critical to note that these differences do not indicate an that the effect of missing speech sounds is not detrimental to listening, but rather indicate that in the case of this study, we cannot reject the null hypothesis that states there is not a difference between successful and non-successful groups with regards to the right ear.

Discriminant analysis: Audiological characteristics. Using all audiogram frequencies (left and right ear at 250, 500, 1000, 4000, and 8000Hz) as well as the Articulation Index (AI) of each ear a discriminant analysis was performed as a multivariate analysis of variance (Table 19). Pure tone averages were excluded as they are not independent from the left and right ear frequency data. The discriminant analysis was not significant (Λ=0.90, χ^2=20.78, *df*=14, Canonical Correlation=0.31, *p*=.107).

Services and Supports

Supports. To determine if differences in support services and amplification use exist between academically successful and academically failing groups, crosstabulations and chi square tests were conducted as all variables were ordinal or categorical. These factors included past and present services received, past and present amplification usage, and hearing loss identification methods. Table 6 provides a summary of the variables, analysis, and results; detailed descriptions can be found within the text that follows. Full table of the comparisons can be found in (Table 20 through Table 25). A discriminant analysis was also performed on all of the services and support variables.

Early intervention and special education services. When examining the sample, a smaller proportion of successful students (3%) received early intervention services than their failing peers (5%). This difference was significant (χ^2=12.50, *df*=1, *p*=.001) and is detailed in Table 22. This represents 4% of successful students and 17% of failing students received early intervention services. This does not indicate that early intervention was the cause of failure, as these services are most often provided on an "as-need" basis based on delay and risk factors. In fact, the dramatic differences may be indicative of greater need identified earlier in life—discussion will follow in Chapter V.

Table 6

Service and Supports Summary

Question: Q14	What services or supports has the child/student with hearing loss received in the PAST? (Check all that have apply). Hearing Aids(s), Amplification System (FM system, speakers in classroom), Early Intervention Services, Special school services (special education, hearing services), Modifications in School (seating close to teacher, teacher notes, etc.), I don't know, No hearing loss present in the past, None. No services were used, Other: ____________________				
Variable	**Type**	**Analysis**	**N**	**Results**	**Significant**
Early Intervention	Categorical	Cross Tabulation/ Chi Square	63	($\chi2$=12.50, df=1, p=.001)	Yes
Special Education Services	Categorical	Cross Tabulation/ Chi Square	63	($\chi2$=37.02, df=1, p=.000)	Yes
Classroom Modifications	Categorical	Cross Tabulation/ Chi Square	63	($\chi2$=18.73, df=1, p=.000)	Yes
Other Services	Categorical	Cross Tabulation/ Chi Square	63	($\chi2$=.603, df=1, p=.508)	
No Services	Categorical	Cross Tabulation/ Chi Square	63	($\chi2$=4.07, df=1, p=.066)	
Personal Amplification	Categorical	Cross Tabulation/ Chi Square	63	($\chi2$=17.76, df=1, p=.000)	Yes
Classroom Amplification	Categorical	Cross Tabulation/ Chi Square	63	($\chi2$=15.12, df=1, p=.000)	Yes

Table 6

(Cont.)

Question: Q41		What services or supports does the child/student CURRENTLY receive? (Check all that apply). Hearing Aids(s), Amplification System (FM system, speakers in classroom), Early Intervention Services, Special school services (special education, hearing services), Modifications in School (seating close to teacher, teacher notes, etc) , I don't know, No hearing loss present in the past, None. No services were used, Other: ___________________			
Variable	**Type**	**Analysis**	**N**	**Results**	**Significance**
Special Education Services	Categorical	Cross Tabulation/Chi Square	63	(χ^2=18.60, *df*=1, *p*=.000)	Yes
Classroom Modifications	Categorical	Cross Tabulation/Chi Square	63	(χ^2=10.12, *df*=1, *p*=.003)	Yes
Other Services	Categorical	Cross Tabulation/Chi Square	63	(χ^2=.0053, *df*=1, *p*=1.0)	
No Services	Categorical	Cross Tabulation/Chi Square	63	(χ^2=1.69, *df*=1, *p*=.291)	
Personal Amplification	Categorical	Cross Tabulation/Chi Square	63	(χ^2=6.88, *df*=1, *p*=.019)	Significant
Classroom Amplification	Categorical	Cross Tabulation/Chi Square	63	(χ^2=8.52, *df*=1, *p*=.009)	Significant
Question: Q15		How is the child served in school?			
Variable	**Type**	**Analysis**	**N**	**Results**	**Significance**
	Categorical	Frequency Count ONLY		(χ^2=44.468, *df*=4, *p*=.000) Regular Education (32%), 504 (24%), IEP (35%), Self-Contained (6%), Other (3%)	

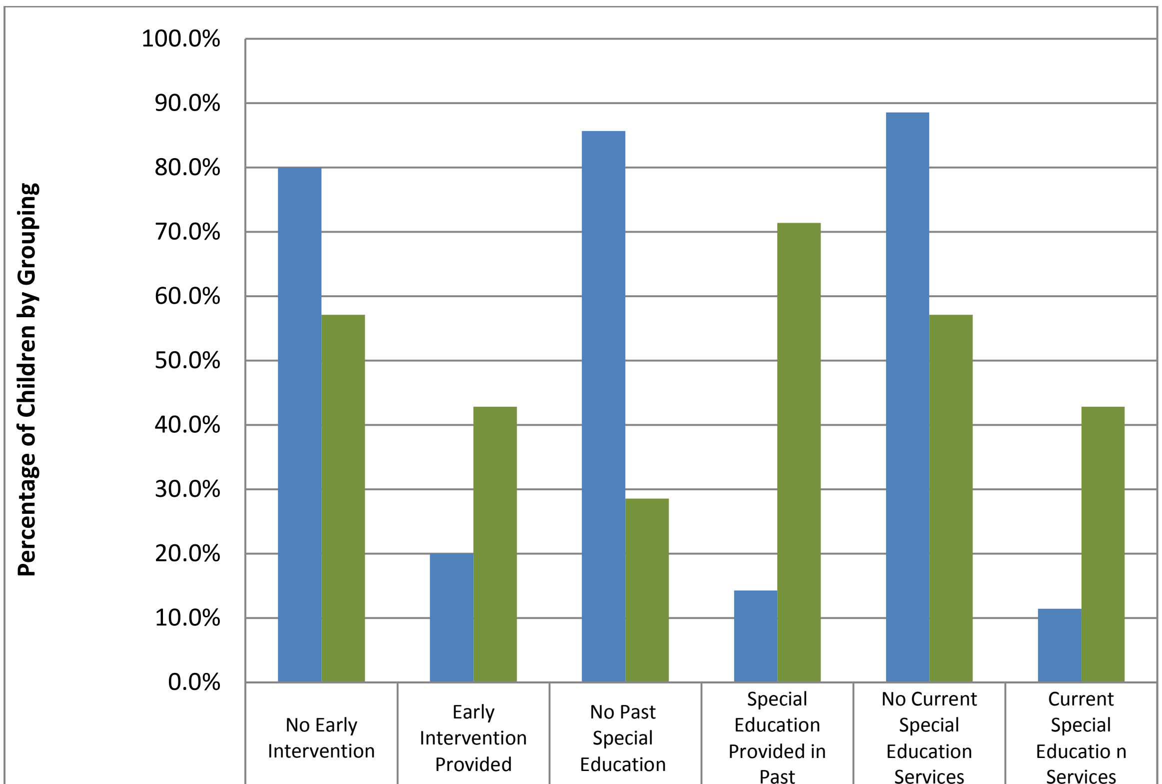
Table 6

(Cont.)

Question: Q80		How often do you follow up with an audiologist, ENT, or medical professional about hearing loss specific needs? More than once a year, Once a year, Every other year, Very rarely, Never			
Variable	**Type**	**Analysis**	**N**	**Results**	**Significance**
Frequency of Follow-up	Ordinal	Cross Tabulation/ Chi Square	57	($\chi2$=5.21, df=4, p=.266)	
Identification Method	Categorical	Cross Tabulation/ Chi Square	56	($\chi2$=4.04, df=4, p=.401)	
Age of Identification	Ordinal	Cross Tabulation/ Chi Square	56	($\chi2$=7.74, df=8, p=.460)	
Etiology	Categorical	Cross Tabulation/ Chi Square	243	($\chi2$=14.78, df=7, p=.03)	Yes
Newborn Hearing Screening	Categorical	Cross Tabulation/ Chi Square	43	($\chi2$=2.03, df=2, p=.362)	
Services and Supports		Discriminant Analysis		(Λ=.201, χ^2=32.083, df=18, Canonical Correlation=0.894, p=.021)	Yes

Likewise, when examining the proportion of students overall who received special education and intervention services (Table 23), failing students (8%) more often than the successful students (2%) were provided services in the past. This represents 20% of successful students and 80% of failing students, and is again likely reflective of provision based on need or risk. These significant differences (χ^2=37.02, *df*=1, *p*=.000) are mirrored in current service provision in that proportionally fewer of the participants who were successful students (2%) received specialized services and failing students (5%). This accounts for 25% of successful students receiving specialized support (+5%) and 75% of failing students receiving specialized support (-5%). This difference in current service provision was also significantly different (χ^2=18.60, *df*=1, *p*=.000). The change in service provision from past to current academic endeavors was also important to note. Service provision for successful students remained fairly stable, with the overall decrease only by 0.4% while 3% of failing students no longer received support services. What is interesting is the change from past to present services for students when examining groups individually; successful students received additional support, while failing students' supports were decreased. No data was collected on time of service cessation related to academic failure.

Classroom modifications. School modifications (Table 24), such as preferential seating and provision of teacher notes, followed a similar pattern to supports services. Previous classroom modifications services were significantly different (χ^2=18.72, *df*=1, *p*=.00), as were current services (χ^2=10.12, *df*=1, *p*=.003). In both past and present classroom modifications, failing students (past 7%; present 4%) were more often receiving services than their successful peers (past 4%; present 4%) when considering the overall percentage of participants. For students who failed, this is a greater decrease in service provision (3%) than their successful peers (<1%) overall. Examining the groups, students in the successful group were more likely to have increased their services (38% → 44%) whereas failing students actually received fewer classroom modifications (62% → 57%).



	No Early Intervention	Early Intervention Provided	No Past Special Education	Special Education Provided in Past	No Current Special Education Services	Current Special Educatio n Services
1.00 Successful	80.0%	20.0%	85.7%	14.3%	88.6%	11.4%
2.00 Failing	57.1%	42.9%	28.6%	71.4%	57.1%	42.9%

Figure 16. Early Intervention and Special Education Services by Group. This figure compares the percentage of participants who received specialized education services.

Other services provided. Participants reported that some children received other services as part of their disability services including: speech services, visual alert systems, surgical interventions, and assistive communication devices (not including classroom amplification). These other services (Table 26) did not indicate significant differences in past (χ^2=.603, *df*=1, *p*=.508) or present (χ^2=.0053, *df*=1, *p*=1.0) services received.

No services provided. Successful students who never received intervention in the past accounted for 4% of the sample, while all failing peers had at least one service or support in the past (Table 25). This accounts for 6% of the successful group never receiving services. This difference (χ^2=4.07, *df*=1, *p*=.066) was not significant in the or present. No difference was noted between groups not receiving services currently (χ^2=1.69, *df*=1, *p*=.291). Currently, 4% of the sample were successful students who did not receive services/supports and <1% were failing students who did not receive services/ supports. This confirms that within groups, successful students (6% → 5% of group did not receive services/supports) increased their service provision and failing students decreased their services (0% → 1% of group did not receive services/supports). No participants indicated uncertainty of their child's past or present receiving services.

Personal amplification. Significant differences were observed in past (χ^2=17.76, *df*=1, *p*=.00) and present hearing aid usage (χ^2=6.88, *df*=1, *p*=.019). These results can be found in Table 20. In the past, a smaller proportion of the sample were successful students wore hearing aids than did their struggling peers (5%, 8%- respectively). The proportion of hearing aid usage remained consistent over time for successful students

(5%); whereas, students who failed academically decreased in their hearing aid usage (5%). Similarly, when exploring just the change within group, the percent change of successful students who wore personal amplification (7.3→7.3%) did not change, but for failing students the proportion within group decreased (27% → 18%)/ It is important to note that this does not imply that hearing aids were the cause of failure, but that hearing aids were more often worn by struggling students and that the frequency of their use by those students decreased. This, like other services, may be reflective of a need determined by struggle or delay, but is impossible to confirm without data on time of cessation of use.

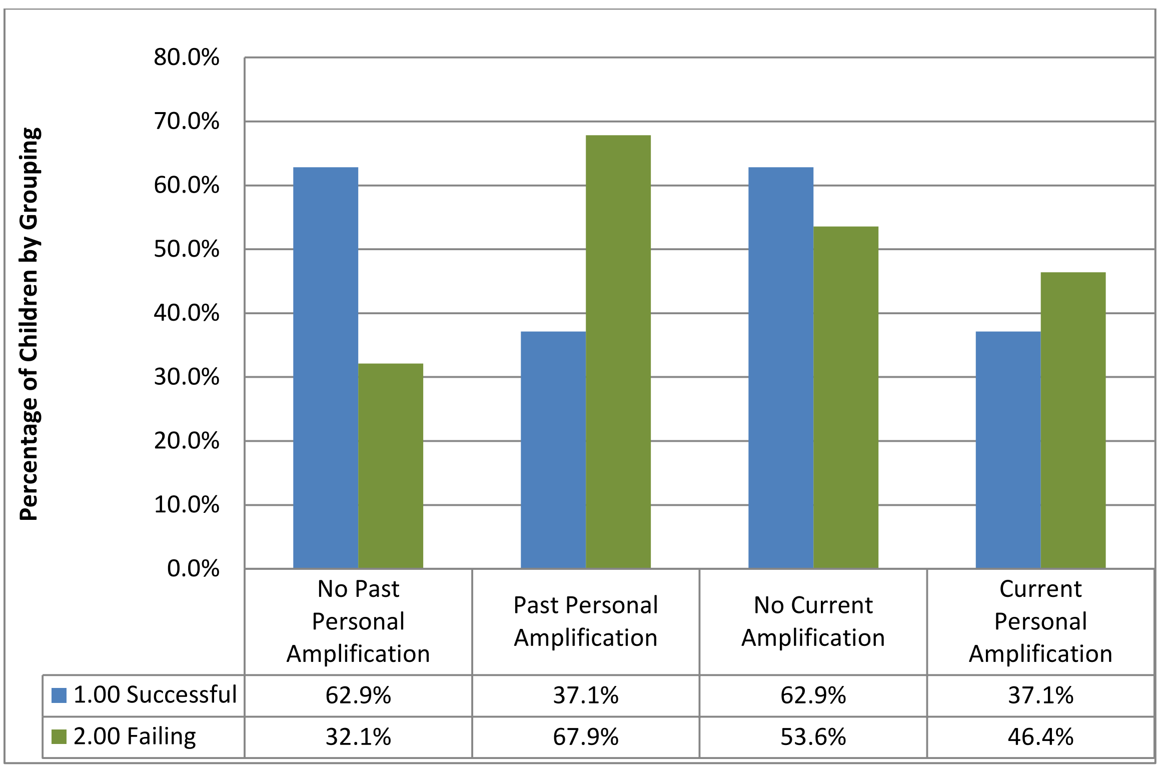
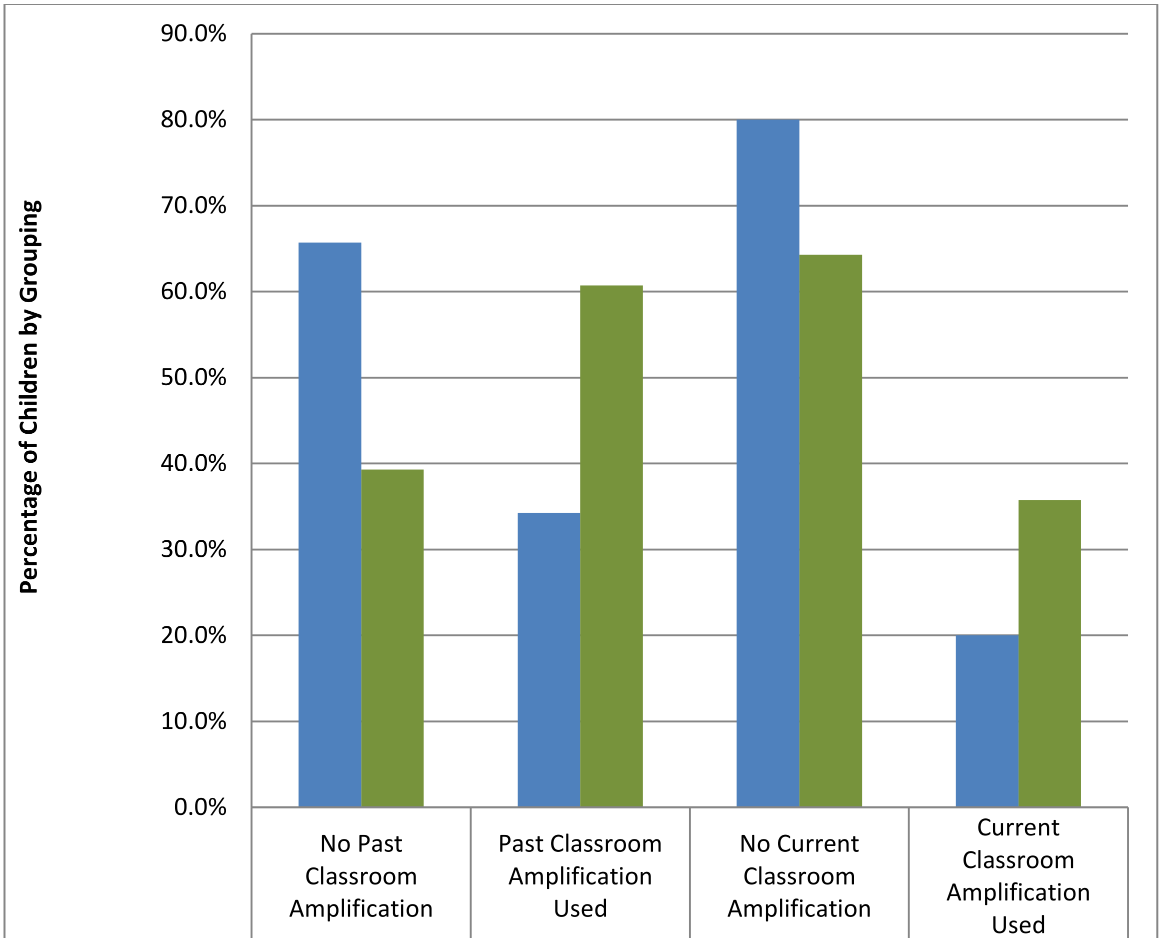


Figure 17. Personal Amplification by Group. This figure compares the percentage of participants who used personal forms of amplification.

Classroom amplification. Significant differences (Table **21**) were observed in past (χ^2=15.12, *df*=1, *p*=.00) and present classroom amplification system usage (χ^2=8.52, *df*=1, *p*=.009). In the past, successful students in the sample used classroom amplification systems less frequently than did their struggling peers (5% and 7%, respectively). Classroom amplification usage decreased for both successful students (3%) and students who failed (4%). This change illustrates a 2% decrease for successful students and a 3% decrease for failing students overall. If examining groups individually, 7% of successful students used classroom amplification in the past and only 4% in the present; while 24% of failing students used classroom amplification in the past and only 14% in the present. It is unknown how this compares to hearing aid use in general hearing loss populations, as amplification cessation research for children was unable to be located.

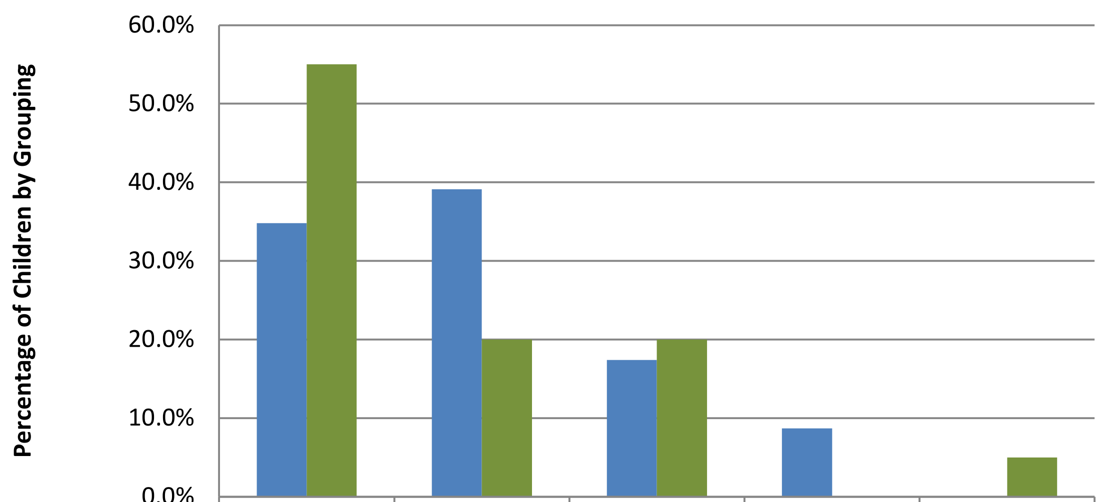
Services. Factors related to hearing loss detection were explored including age of onset, identification process, etiology of hearing loss, and early services. These factors reflect the knowledge that early identification and intervention in greater degrees of hearing loss is often attributed to more successful outcomes because of early intervention (Yoshinaga-Itano, 2003). Fifty-six respondents provided information regarding age of detection, 43 responded about newborn hearing screening processes, 56 about the method of detection, and 243 responded with a cause (etiology) of hearing loss. The variables for interventions and amplification were included in the discriminant function.



	No Past Classroom Amplification	Past Classroom Amplification Used	No Current Classroom Amplification	Current Classroom Amplification Used
1.00 Successful	65.7%	34.3%	80.0%	20.0%
2.00 Failing	39.3%	60.7%	64.3%	35.7%

Figure 18. Classroom Amplification Usage by Group. This figure compares the percentage of participants who used classroom forms of amplification.

Frequency of follow-up. Few participants indicated their follow-up by audiology professionals (Table 27) regarding hearing management and care. Of 249 participants, 43 indicated any frequency of follow-up. Seventy participants indicated referral recommendations, but they did not indicate receiving follow-up services. Of those that did respond about the frequency of receiving follow-up audiological services, no significant differences were noted between groups (χ^2=5.21, *df*=4, *p*=.266). Overall, a greater percentage of children who failed followed up with a hearing professional more than once a year (26% of sample, vs 19% of the sample.) This indicates that 55% of children who failed reported more than once a year for hearing care, while only 35% of successful students reported more than once a year. Typically, children report for hearing care once annually. Of the sample, 21% of children who attended annually were successful (39% of the group). Nine percent of children who attended annually failed academic (20% of group).



	More than once a year	Once a year	Every other year	Very rarely	Never
1.00 Successful	34.8%	39.1%	17.4%	8.7%	0.0%
2.00 Failing	55.0%	20.0%	20.0%	0.0%	5.0%

Figure 19. Comparison of Follow-up by Group. This figure compares the percentage of participants and their follow up frequency with hearing healthcare professionals.

Bi-annual follow up was reported by 19% of the respondents, which each group representing 9% of the sample. Within groups, 17% of successful students group and 20% of the failing group reported only every other year. Five percent of the population rarely followed up with a hearing professional, all of which were successful students (9% of the group). Two percent of the sample (5% of the failing group) never followed up with hearing care professionals.

Identification method. Most children of the 57 reported were identified because of parent or family concern (52%), whereas newborn hearing screening identified an additional 23% of children with mild or unilateral hearing losses. School referral accounted for 16% of children identified. Physician concern accounted for only 9% of identification of hearing loss. Identification methods (Table 33 and Figure 20) were similar for both groups, with the exception of physician concern and school referral. Successful students were more frequently identified through physician concern (7%) than their failing counterparts (2%). The exact opposite results were present in school referral, in which only 5% of successful students were identified by schools and 11% of failing students were identified by schools. These differences were non-significant (χ^2=4.04, df=4, p=.401).

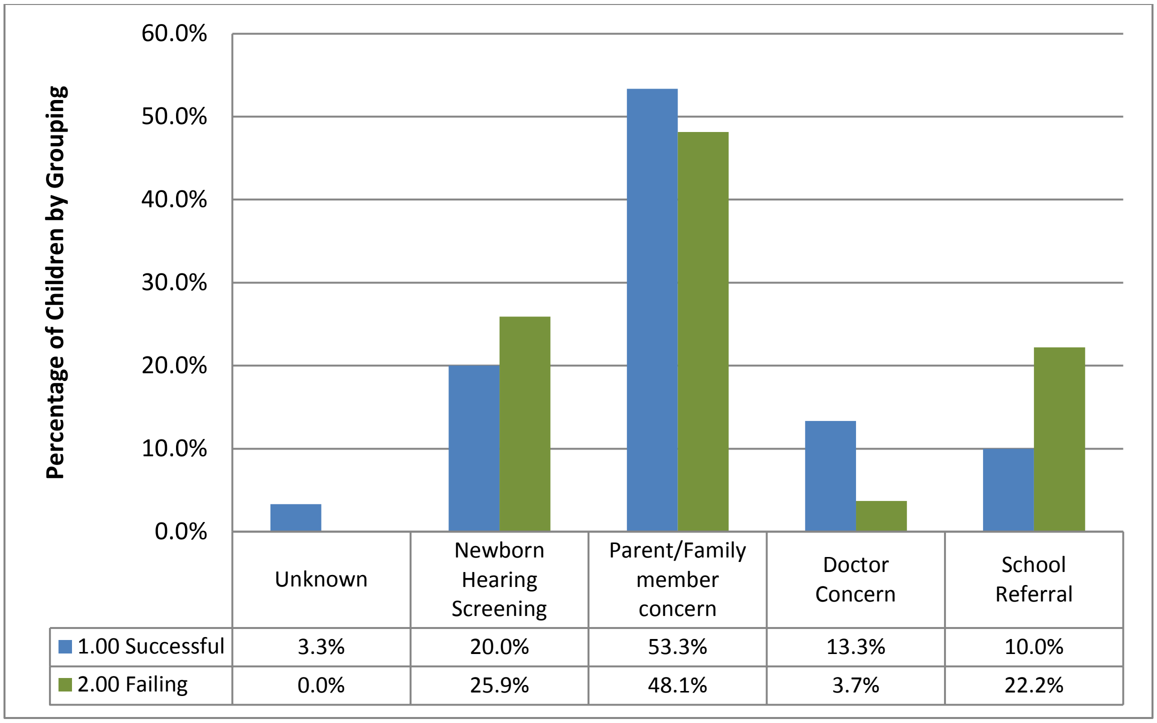


Figure 20. Method of Detection by Group. This figure compares the person who identified a hearing loss concern between groups.

Age of detection. A majority of children (48%) with mild or unilateral hearing loss were identified from birth to 2 years of age (see Table 29 and Figure 21). Successful students represent 54% of the children identified from birth through 2 years of age; whereas, students who would later fail academically represented 46% of those children identified early in life. More specifically, more students who are successful were more frequently identified between birth and year one; whereas, children who were less successful were more frequently identified between the first and second year of life.

Children identified between ages 3-5 represented 30% of participants who provided information on the children's age of identification. For successful children, a slight increase was seen in identification each year from age 3 through 5. Failing students however, were predominately identified in the 5th year of their lives. This increase in identification is likely due to school screening procedures. Finally, 23% of children were identified at or after the age of-six. A greater percentage of these children who failed academically (13%) were identified in later years when compared to successful students (11%). Measurements of skewness (Table 31) reaffirm the finding of a tendency for later identification for failing students (-0.37) compared to that of successful students (-0.01). Differences between these groups (Table **30**) are non-significant (χ^2=7.74, *df*=8, *p*=.460).

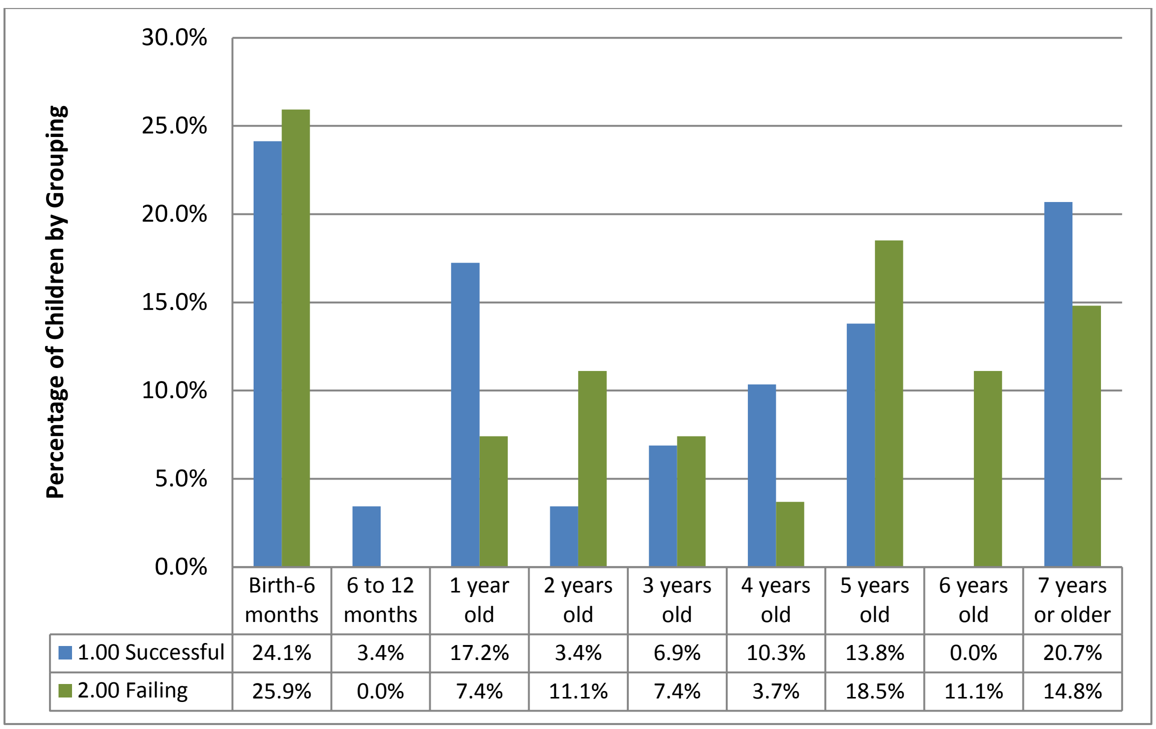


Figure 21. Age of Detection. This figure compares the age of identification between groups.

Etiology. The cause of hearing loss was described by 59 of the respondents. A majority of cases, as with all degrees of hearing loss (Harrison, Roush, & Wallace, 2003) the cause of hearing loss remained unknown (73%). Injury (7%) and infection (6%) accounted for the next greatest cause of hearing loss. Other causes such as birth, illness, genetics, and other causes represented the cause of hearing loss in the remaining portion of children. Significant differences were present between successful and failing students (χ^2=14.78, *df*=7, *p*=.039). The difference in proportion of representation by each grouping shows children who failed academically more often had hearing loss associated with genetic conditions, illness, infection, or injury than did successful children.

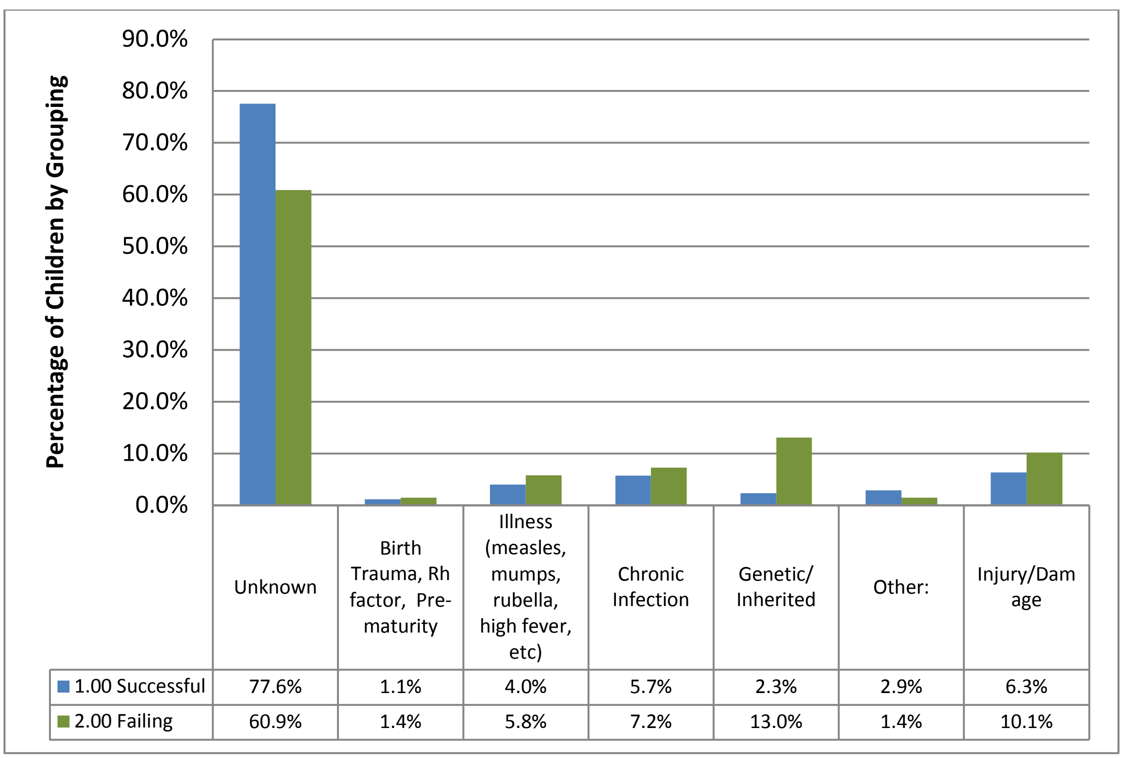


Figure 22. Etiology. This figure compares the identified cause of hearing loss between groups.

Newborn hearing screening. Participants were asked if children's hearing loss was present during a newborn hearing screening. The distribution of the 43 responses can be found in Table 32 or Figure 23. Of these responses, 33% were unaware of hearing status from a newborn hearing screening, 47% indicated no loss was present, and 21% indicated a definite presence of hearing loss. A greater percent of parents of failing students (21%) were unaware of hearing status at birth than successful students (12%). More students who were successful were confirmed as acquired hearing loss in the successful group (28%) than the failing group (19%). These differences, detailed in Table 6, were not significant (χ^2=2.03, *df*=2, *p*=.362).

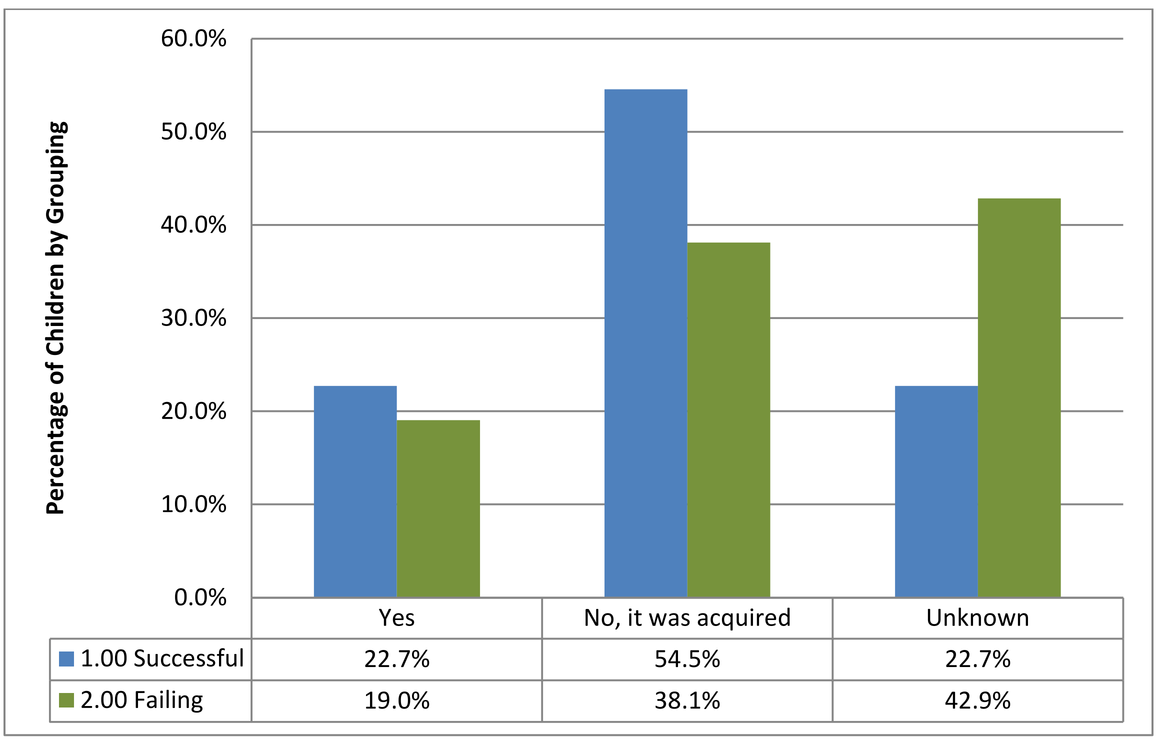


Figure 23. Presence of Hearing Loss at Birth. This figure show the percentage of children identified through the newborn hearing screening in each group.

Discriminant analysis. Using all interventions past and present (hearing aids, amplification systems, early intervention, school services, modifications, no services, other services, follow-up frequency) as well as identification factors (age of onset, identification method, etiology, and presence at birth) a discriminant analysis was performed as a multivariate analysis of variance. The discriminant analysis (Table 28) was significant (Λ=.201, χ^2=32.083, *df*=18, Canonical Correlation=0.894, *p*=.021). The discriminant analysis, "Past Services" loads heavily on only one of these 18 variables, Past special school services.

SIFTER Results

Introduction

The SIFTER rating instrument is used to predict academic risk for children with hearing loss (Anderson, 1989). This instrument incorporates two sets of matched questions; one for elementary aged children and one for middle/high school students. Each set contains 5 sections: academics, attention, communication, participation, and behavior. According to the instructions for the appropriate use of SIFTER, a score in any section of 7 or less is a failing response and should be followed up with academic testing, scores between 8 and 9 are marginal and should be monitored, and 10-15 is a passing score. A pictorial representation of scoring norms and standard deviation is located in Figure 24. Parents of successful children rated their children higher than parents of failing children only in the areas of Academics and Communication. In all other areas (Attention, Participation, and Behavior), parents of successful students perceived their children as having weaker skills than did parents of failing students. Significant differences were observed in Attention, Communication, and Behavior. Both descriptive and discriminant analysis were conducted and are provided below in Figure 24 and Table 7.

CONTENT AREA	TOTAL SCORE	PASS	MARGINAL	FAIL
ACADEMICS		15 14 13 12 11 10	9 8	7 6 5 4 3 2 1
ATTENTION		15 14 13 12 11 10	9 8 7	6 5 4 3 2 1
COMMUNICATION		15 14 13 12 11 10	9 8	7 6 5 4 3 2 1
CLASS PARTICIPATION		15 14 13 12 11 10 9	8 7	6 5 4 3 2 1
SCHOOL BEHAVIOR		15 14 13 12 11	10 9	8 7 6 5 4 3 2 1
		+1 SD	Mean	-1 SD -2 SD

Figure 24. SIFTER Score Distribution. This figure illustrates the range of scores at performance level for each section of the SIFTER dimensions.

Because the SIFTER is designed based on the normal distribution, Q-Q plots will be included in the results, along with histograms and description of distribution. Q-Q plots are exploratory visualizations used to compare the quantiles (points taken at regular intervals) of two distributions. The Q-Q plot can compare theoretical or actual distributions. Q-Q comparisons are conducted as a more powerful way to compare histograms. When comparing two sets of data (actual or theoretical), the interpretation is based on the shape of the distribution produced. A normal distribution is indicated by points that fall on or near to the line. "S shaped" distributions indicate that at least one of the distributions is skewed. An arched or "u shaped" distribution can indicate positive (U opens upward) or negative distribution (U opens downward).

Table 7

SIFTER Summary

Question: R/S Variable	Type	SIFTER SCALE (See Appendix B for individual questions) Analysis	N	Results	Significant
Academics	Scale	T-Test	64	*t*(50.55)=1.34, *p*=.186, 95%CI [-0.69, 3.48], *r*=.19	
Attention	Scale	T-Test	64	*t*(62)=-2.14, *p*=.036, 95%CI [-4.37, -0.15], *r*=.26	Yes
Behavior	Scale	T-Test	64	*t*(62)=2.25, *p*=.028, 95%CI [19, 3.26], *r*=.28	Yes
Communication	Scale	T-Test	64	*t*(62)=-1.04, *p*=.303, 95%CI [-2.43, .77], *r*=.13	Yes
Participation	Scale	T-Test	64	*t*(62)=-2.50, *p*=.015, 95%CI [-3.92, -.44], *r*=.30	
Self-Advocacy	Scale	T-Test	50	*t*(62)=-0.36, *p*=.723, 95%CI [-1.57, 1.10], *r*=.05	
Total	Scale	T-Test	64	*t*(62)=-0.67, *p*=.504, 95%CI [-8.57, 4.26], *r*=.09	
TotalPLUS	Scale	T-test	62	*t*(62)=-0.326, *p*=.745, 95%CI [-7.94, 5.71], *r*=.09	
SIFTER		Discriminant Analysis	212	Λ=0.73, χ^2=18.29, *df*=6, Canonical Correlation=0.52, *p*=.006	Yes

The hypothesis which states that there are no differences between successful and failing students would lend itself to normally distributed QQ Plots for both groups. However, if the successful students are rated higher, it would be expected that s or u shaped distributions would be observed with a negative skew, as negatively skewed distributions will indicate higher scores.

Academics. Three questions on SIFTER pertain to academic performance of children with mild or unilateral hearing losses. Younger students' parents/guardians/ were asked questions related to reading level, ability of child to process information, and rate of growth academically. Older students' parents/guardians were asked about class standing, achievement levels, and reading level. Questions can be located in Appendix A: Research Design Logic Model.

Visual inspection of histograms (Figure 25) provides additional insight into the ratings of children by their parents in the area of academics. Parents of highly successful children concentrated their ratings on academic performance; very low (3) and high (15). Mid ranges were distributed in a depressed, flat manner. Conversely, students who are failing were rated by parents most frequently as average (10-12) with high ratings (13-15) being infrequent, in a near normal distribution. Thus, parents of failing students have a more moderate view of their children's academic performance: whereas, parents of students who are successful view their academic performance in a binary success/failure fashion. Q-Q Plots (Figure 25) and the Shapiro-Wilk test (Table 33) reaffirm the non-normality of distribution of academic ratings for successful students (p=.000) versus a normal distribution failing students (p=.118). Skewness of both groups (Table 36) was slightly negative (successful = -0.62; failing = -0.17), indicating slight tendency for parents to rate their children higher on scales.

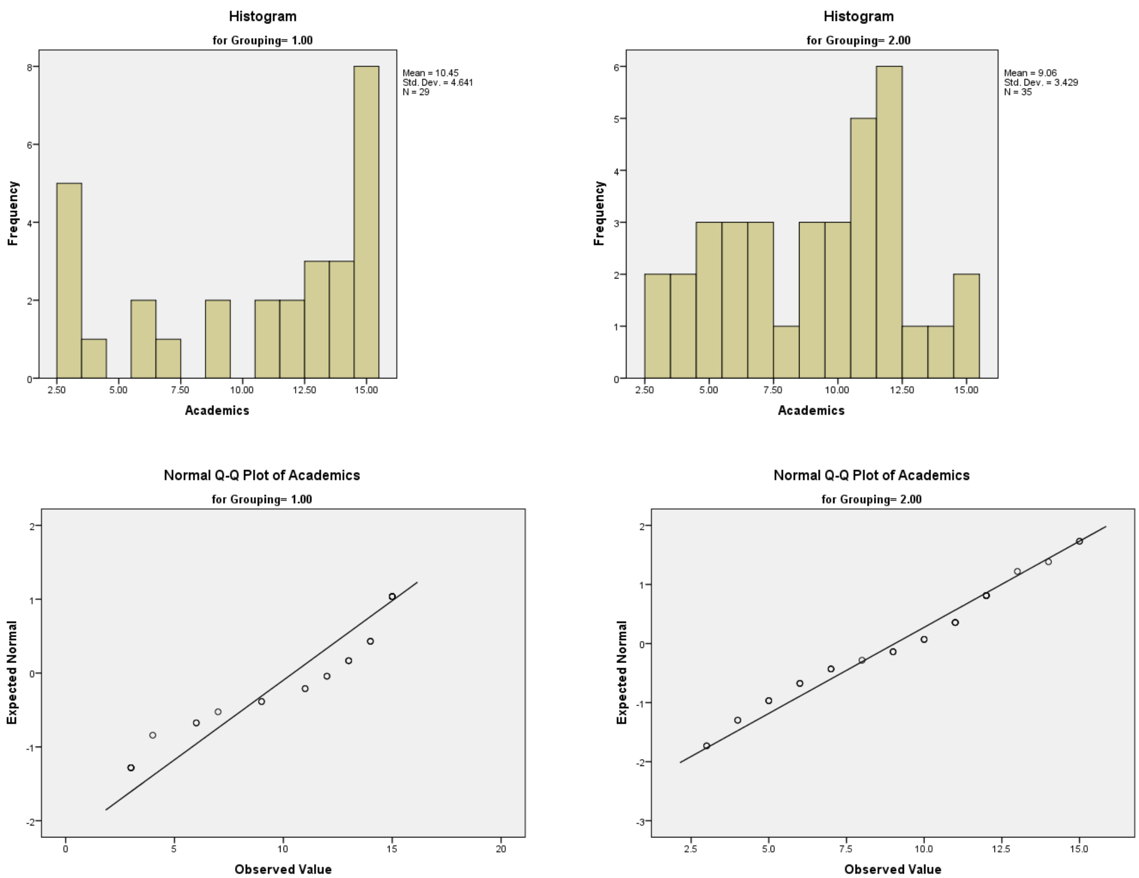


Figure 25. Academic Histogram and Q-Q Plots. This figure shows the non-normal distribution of SIFTER ratings by parents of successful and failing children.

The mean of ratings for children who were successful in school were higher (10.45) than their academically failing peers (9.056). On average, students who were successful were within the passing range for SIFTER categorical scores; whereas, the ratings for failing students fell within the marginal range on average. T-tests indicated the differences between groups on academic SIFTER score was not significant: *t*(50.55)=1.34, *p*=.186, 95% CI[-0.69, 3.48], with a small effect size (*r*=0.19).

Attention. SIFTER includes three questions related to the attention span of children with mild or unilateral hearing losses. Younger students' parents/guardians were asked questions about their child's ability to attend to a speaker, avoid distractions, and ability to pay attention to detail. Older students' parents/guardians were asked about a child's distractibility, attention span, and hesitation to answer when spoken to. Questions can be located in Appendix A: Research Design Logic Model. The mean of ratings of the attention of children who were successful in school was lower (5.97) than those their academically failing peers' ratings (8.23). Students who did not fail were within the fail/ high-risk range for SIFTER categorical scores; whereas, the scores of failing students fell within the marginal range on average. Skewness (Table 36) of both were different, with a positive skew indicating lower scores for successful students and a near normal, slightly-negative score for failing students (successful=1.11; failing=-0.12). T-tests indicated significant differences between groups *t*(62)=-2.14, *p*=.36, 95% CI [-4.37, -0.15], with a medium effect size (*r*=0.26).

Visual inspection Q-Q Plots (Figure 26) and the Shapiro-Wilk test indicate the non-normality of distribution of attention ratings for successful students (*p*=.000) and failing students (*p*=.007). Histogram distributions (Figure 26) show that attention ratings for successful students were predominately in the 3-4 range, with an equal and less concentrated distribution across other values. Attention ratings for failing students most heavily fell on 3, 9, and 11. Students who fail were more frequently rated as having attention span in marginal or passing ranges on the SIFTER.

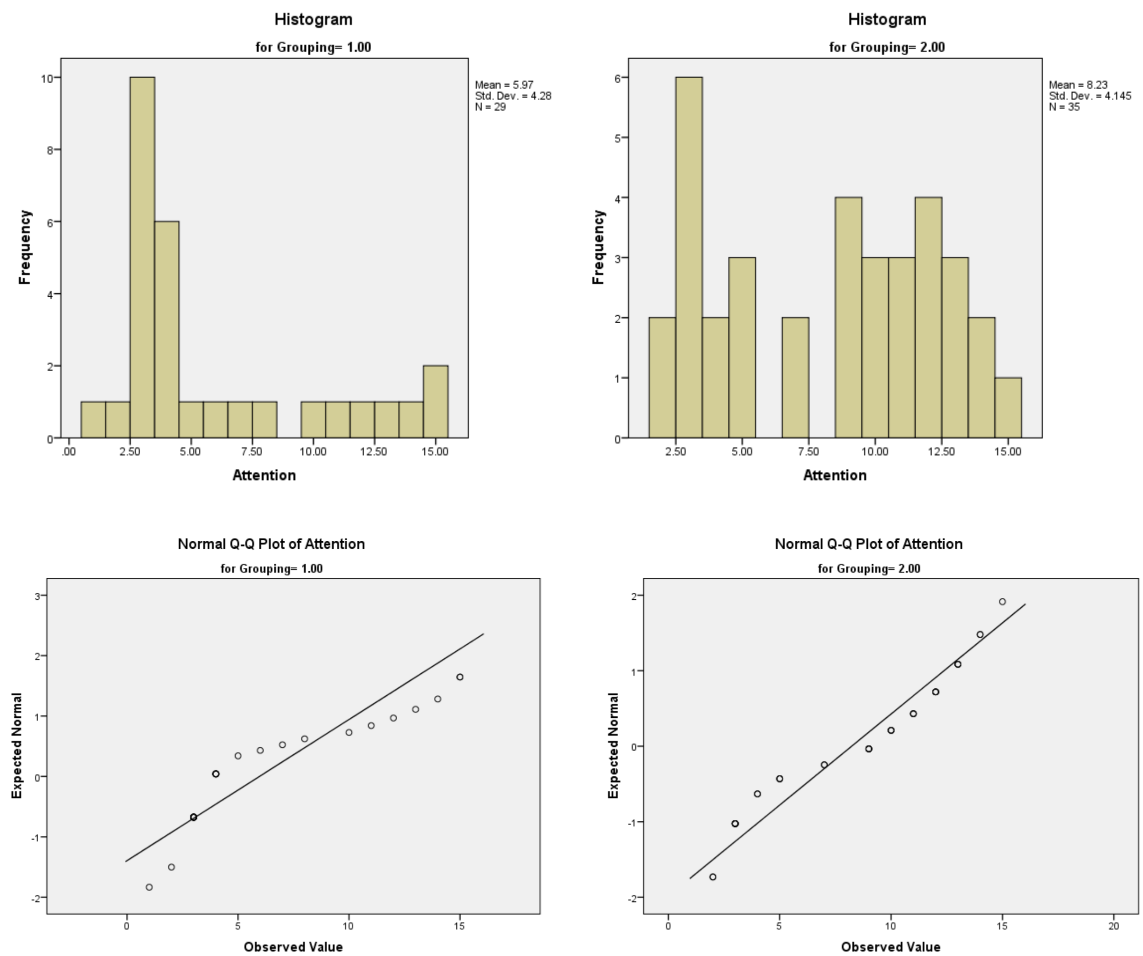


Figure 26. Attention Histogram and Q-Q Plots. This figure compares the SIFTER scores for the domain of attention.

Communication. Three questions on SIFTER related to the communication abilities of children with mild or unilateral hearing losses. Younger students' parents/guardians were asked questions about communicating needs, word usage, and ability to understand instruction. Older students' parents/guardians were asked comprehension of instruction, word usage, and proficiency in retell. Questions can be located in Appendix A: Research Design Logic Model.

Visual inspection Q-Q Plots (Figure 27) and the Shapiro-Wilk test indicated the normality of distribution of communication ratings for successful students (p=.145) and failing students (p=.706). Histogram distributions (Figure 27) show that communication ratings for successful show a bimodal distribution (8,11) with a tendency to rate children between the scores of 10-15. Communication ratings for failing students most heavily fall within the range of 5-9, with the most frequent value being displayed at 9. Skewness (Table 36) for both groups differed with successful students having a negative skew (successful=-0.44) and a slightly positive lean for failing students (failing=0.32). This indicates that parents of failing students rated their children more favorably (higher scores) than parents of failing students.

The mean of parents' ratings for children who were successful in school were higher than those of their academically failing peers parents' ratings. With regard to communication abilities, students who did not fail were within the passing range for SIFTER categorical scores; whereas, the ratings of failing students fell within the marginal range on average. T-tests indicated significant differences between groups $t(62)=2.25$, $p=0.028$, 95% CI[.194, 3.26], with a medium effect size ($r=0.28$).

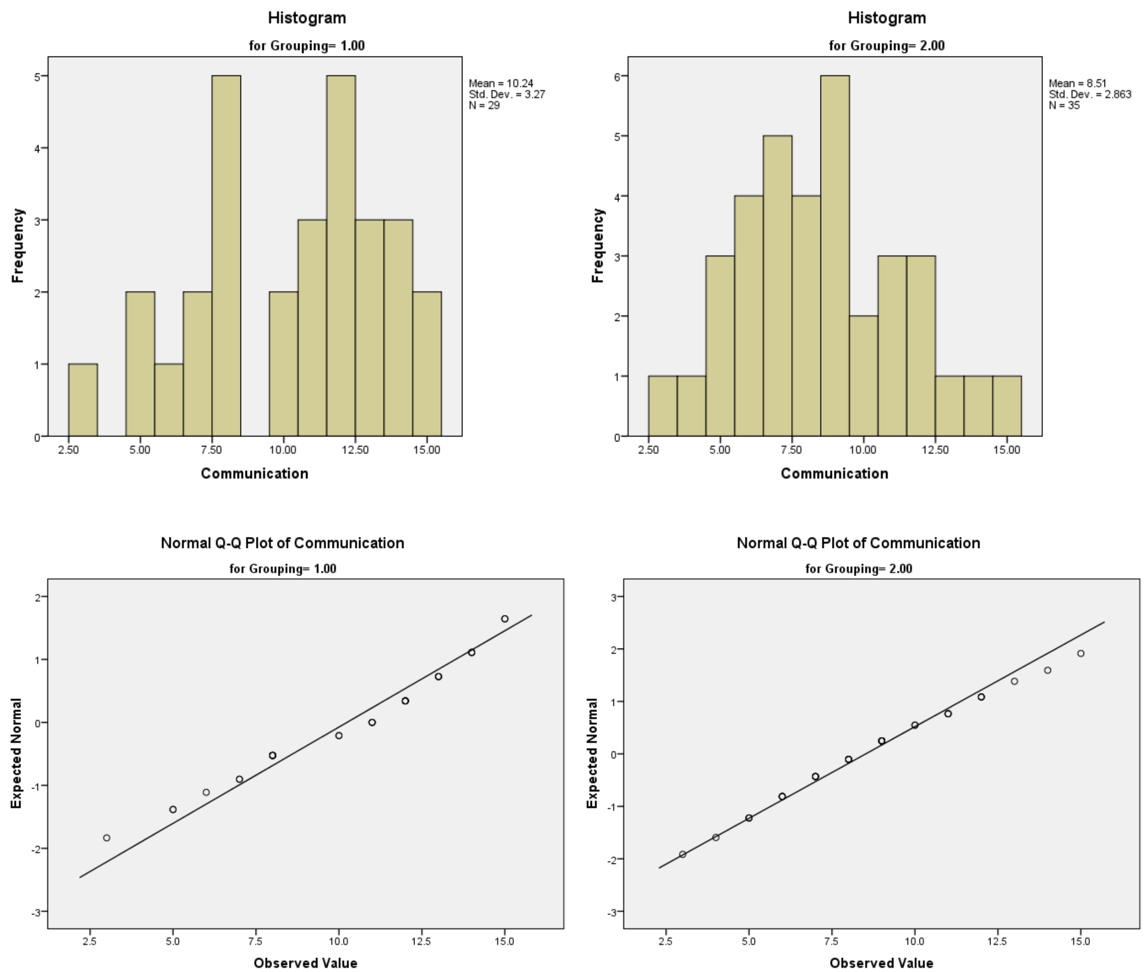


Figure 27. Communication Histogram and Q-Q Plots. This figure compares the distributions of SIFTER scores for the domain of communication.

Participation. Three questions were asked related to the participation of children with mild or unilateral hearing losses in academic activities. Younger students' parents/guardians were asked questions about contribution to discussion, recognizing importance of participating, and cooperative engagement in groups. Older students' parents/guardians were asked about student's voluntary participation in class, completion of homework, and ability to work independently.

Histogram distributions (Figure 28) indicate that participation ratings for academically successful students show distribution with ratings evident between the scores of 8-11. Participation ratings for failing students most heavily fall in the range of 8-13, with the most frequent value being displayed as 11. Parents of failing students rated their children with participation scores lower than 8. Visual inspection Q-Q Plots (Figure 28) and the Shapiro-Wilk test (Table 37) indicate the normality of distribution of attention ratings for successful students (p=.291) and failing students (p=0.175). Skewness for both groups are near normal with a slightly negative lean for failing students (failing=-0.35) and slightly positive lean for successful students (successful= -0.75).

The mean of parents' ratings for children who were successful in school were lower than their academically failing peers parents' ratings. With regard to participation in class, students who did not fail were within the marginal range for SIFTER categorical scores; whereas, failing students fell within the passing range on average. T-tests indicated non-significant differences between groups $t(62)=-1.04$, p=.303, 95% CI[-2.43, 0.77], with a small effect size (r=0.13).

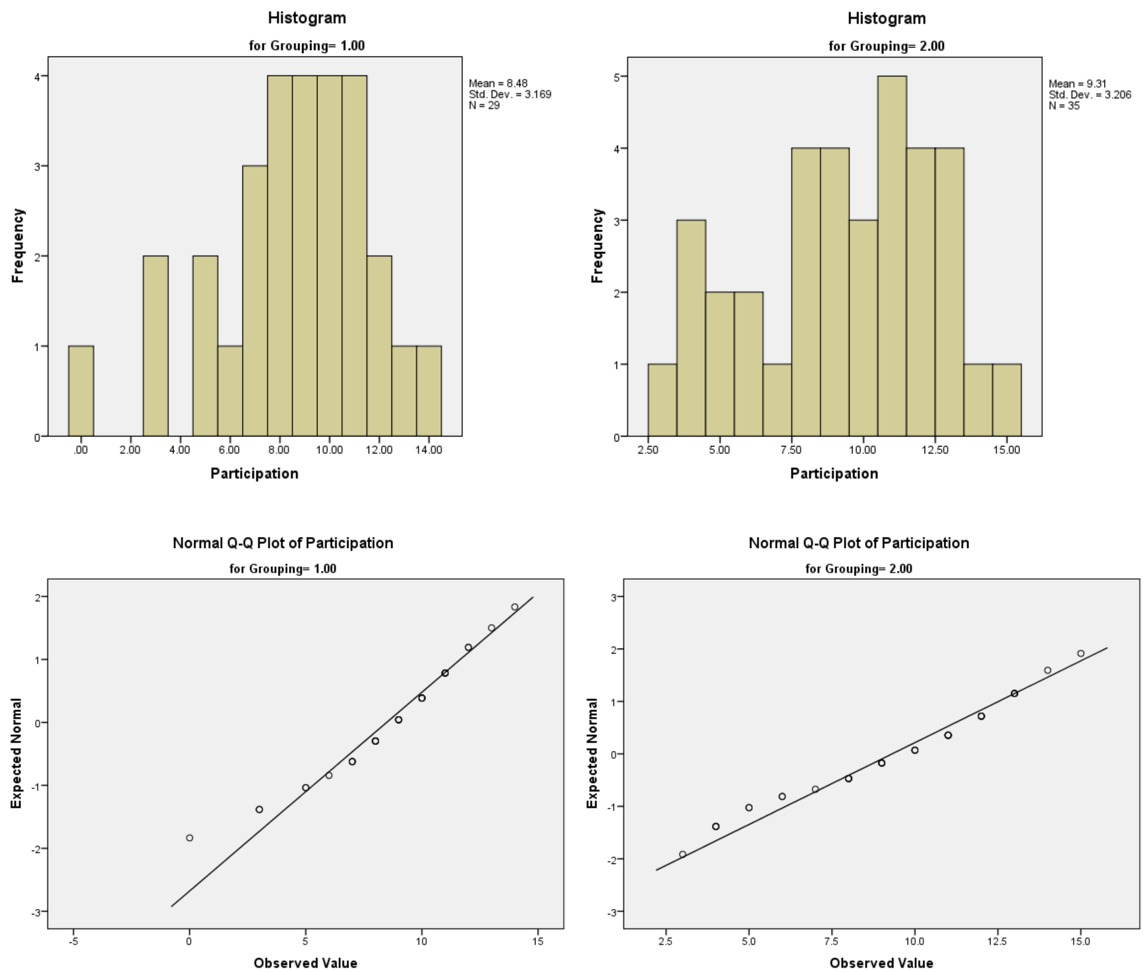


Figure 28. Participation Histogram and Q-Q Plots. This figure compares the distributions of SIFTER scores for the domain of participation.

Behavior. Three questions were asked related to the behavior of children MB/UHL. Younger students' parents/guardians were asked questions concerning respectful behavior, following rules, and peer relationships. Older students' parents/guardians were asked about age appropriate behaviors, emotional control, and relationships with peers.

Histogram distributions (Figure 29) indicate that behavior ratings for successful students show distribution with a tendency for parents/ guardians to rate children between the scores of 4-10 with possible outliers at 0 and above 12. Ratings of the behavior of failing students were more evenly distributed across ratings, with stronger representation at 6, 9 and 15. Parents of failing students were more likely to rate their children as having positive behavior variables. Visual inspection Q-Q Plots (Figure 29) and the Shapiro-Wilk test indicate the non-normality of distribution of attention ratings for successful students (p=.002) and failing students (p=.026). Skewness (Table 36) of successful students was slightly positive (0.598); whereas, skewness of failing students was near normal (0.067).

The mean of parents' ratings for children who were successful in school were lower than those of their academically failing peers parents' ratings. With regard to behavior, students who did not fail were within the high risk/fail range for SIFTER categorical scores; whereas, the ratings of failing students fell within the marginal range on average. T-tests indicated non-significant differences between groups $t(62)=-2.50$, p=.015, 95% CI-3.92, -.44], with a medium effect size (r=0.30).

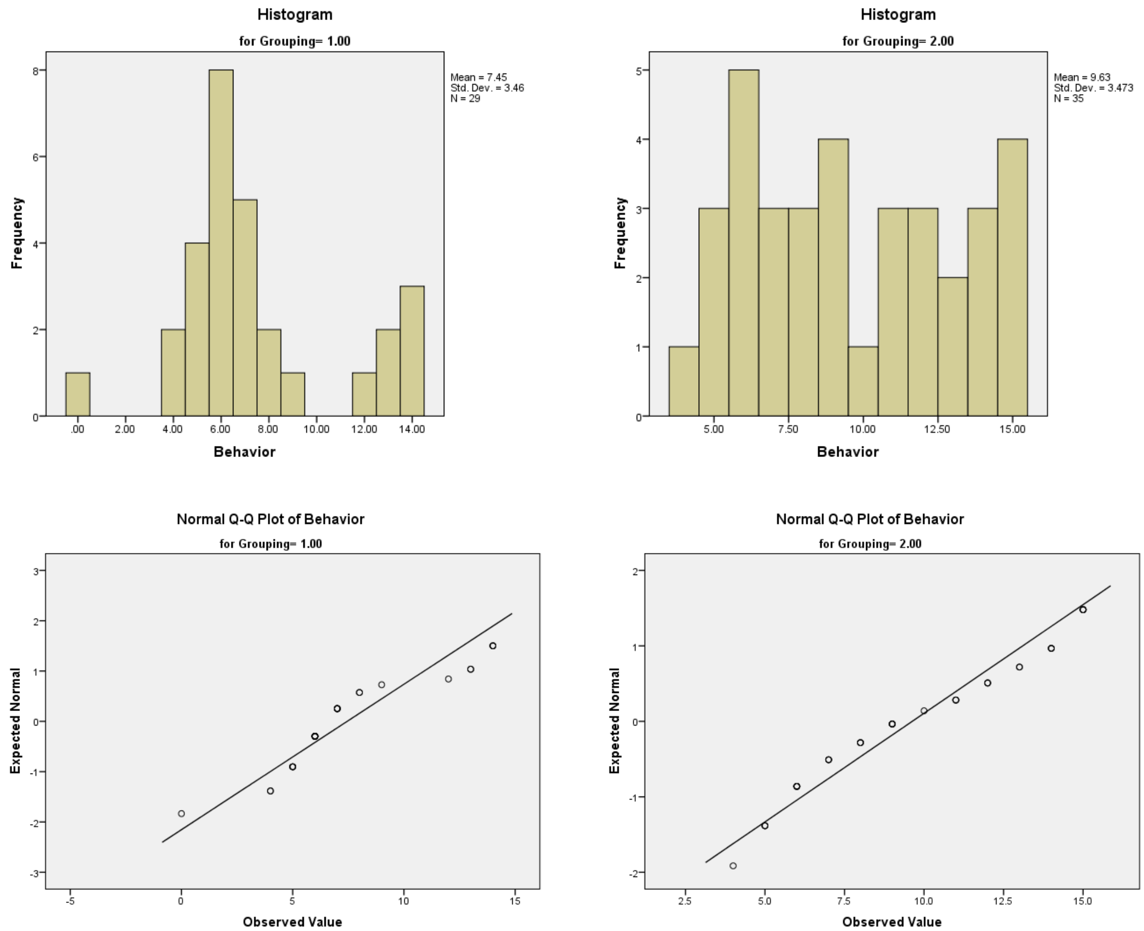


Figure 29. Behavior Histogram and Q-Q Plots. This figure compares the distributions of SIFTER scores for the domain of behavior.

Self-advocacy. One additional question was created to mirror the format of the SIFTER rating scale in order to explore students' ability to self-advocate. The question asked parents/guardians if their children understood and could advocate for their needs in the classroom. No significant differences were observed in the self-advocacy variable; $t(48)=-0.36$, $p=.34$, 95% CI[-1.57, 1.1], with a small effect size ($r=0.05$) and distribution was non-normal (Figure 30).

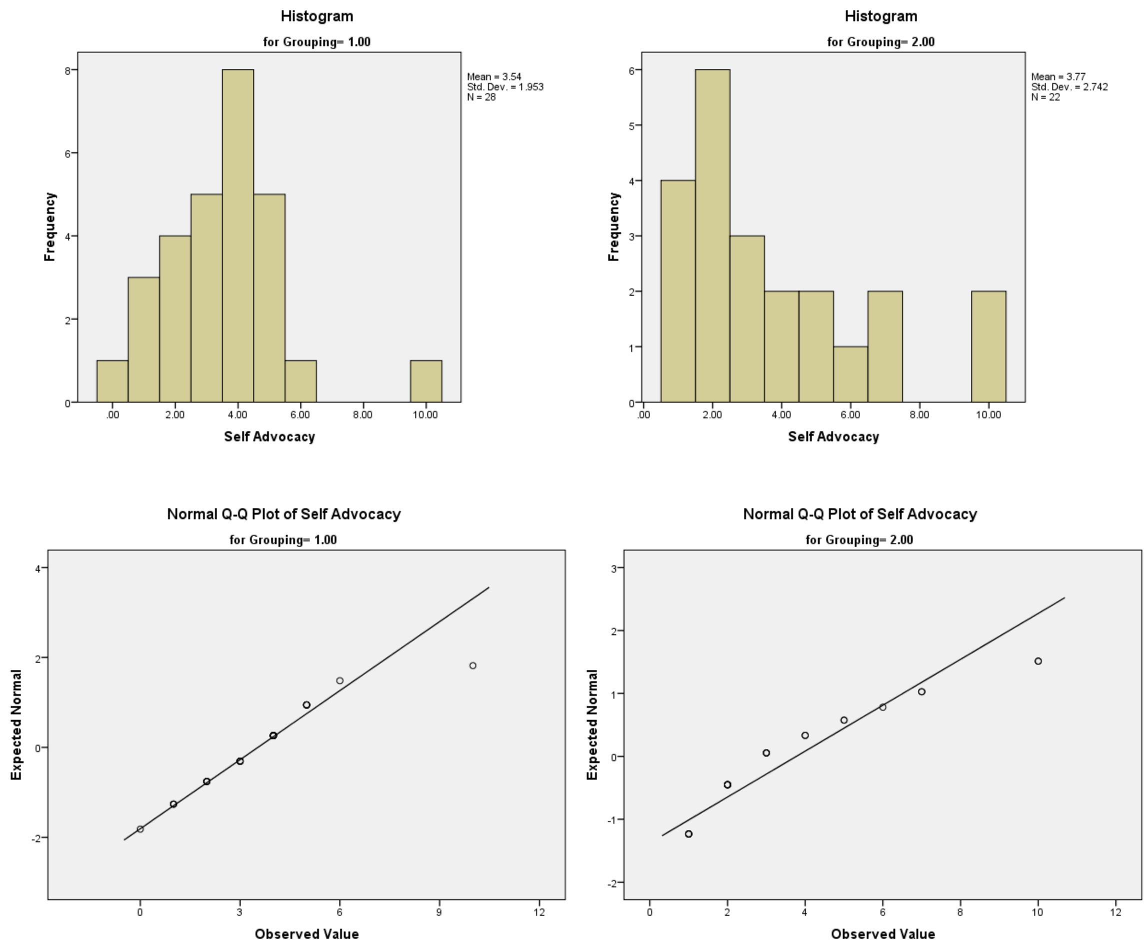


Figure 30. Self-advocacy Histograms and Q-Q Plots. This figure compares the distributions of SIFTER scores for the domain of communication.

Histogram distributions (Figure 30) indicate that participation ratings for academically successful students show distribution with ratings evident between the scores of 0-4, and 1-7 for failing students. Parents of failing students rated their children with participation scores higher than successful students. Visual inspection Q-Q Plots and the Shapiro-Wilk test (Table 37) indicate the normality of distribution of self-advocacy ratings for successful students (*p*=.015) and failing students (*p*=0.004).

Skewness for both groups are near normal with a slightly for failing students (0.07) and slightly positive lean for successful students (0.60).

SIFTER Total and SIFTER Plus. Total SIFTER scores were calculated from the sum of the five categories, with range of 0–75 points. The parent ratings of most students tended to saturate in the middle of the SIFTER scale indicating marginal to low risk overall ratings (Figure 31).

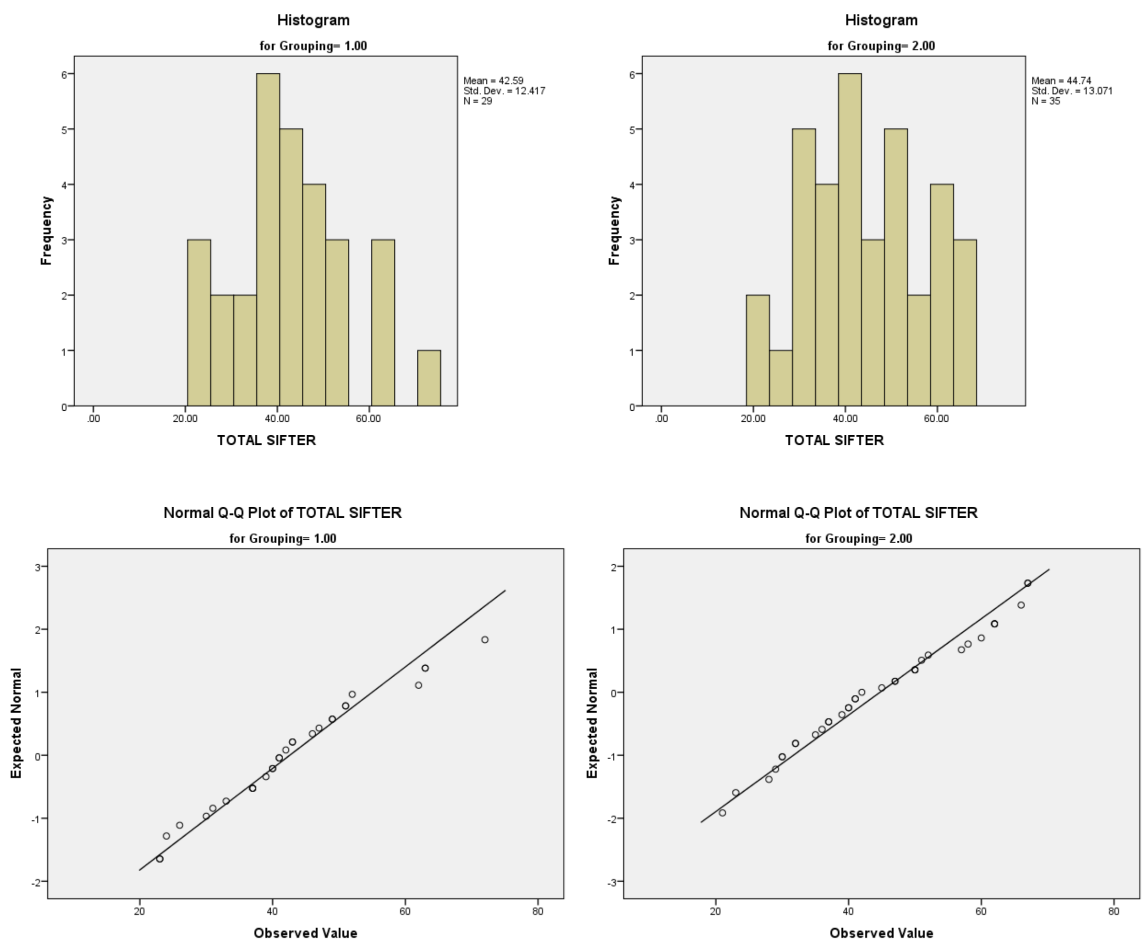


Figure 31. SIFTER Total Histograms and Q-Q Plots. This figure compares the distributions of SIFTER scores for the sum of all SIFTER scores.

Mean scores for total scores in successful students were 42.59 and 44.74 for failing students. Scores for both groups displayed a slight positive skew, however scores were normally distributed according to Shapiro-Wilk significant tests (successful=0.38; failure=0.26). Significant differences were not observed between groups; *t*(62)=-.67, *p*=.504, 95% CI[-8.57, 4.26], with a small effect size (*r*=0.09).

Normal distribution (Figure 32) was observed in the Shapiro-Wilk significance test (successful=.036, failing=-0.53) for the SIFTERPlus variable. Means between groups were similar to those of successful students (46.0) having slightly lower scores than failing students (47.11). No significant differences between groups were observed; *t*(62)=-0.33, *p*=.745, 95% CI [-7.94, 5.72], with a small effect size(*r*=0.09). This indicates that there were no differences between overall ratings in parent ratings of children with MB/UHL who were successful in school and who failed academically.

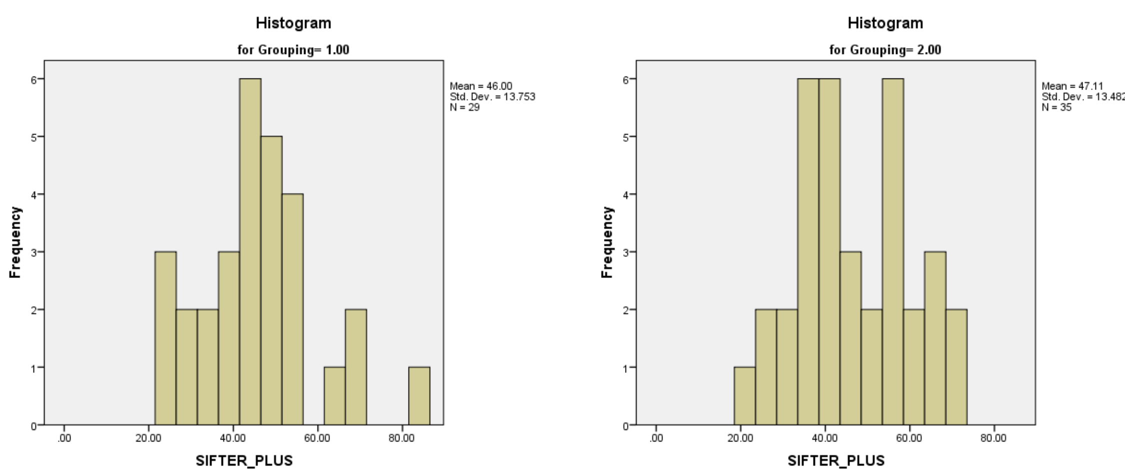


Figure 32. SIFTER Plus Histogram and Q-Q Plots. This figure compares the distributions of SIFTER scores for the sum of SIFTER scores with self-advocacy included.

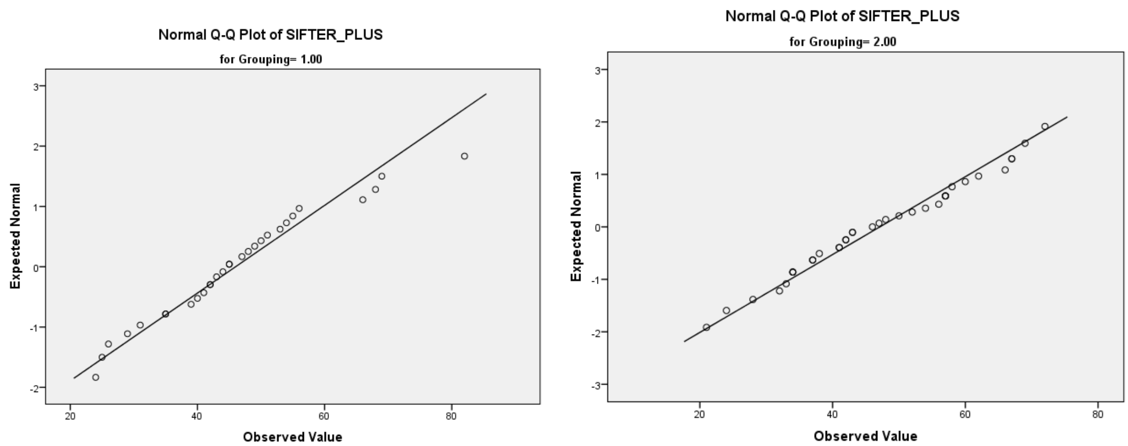


Figure 32. (Cont.)

Discriminant analysis. Using the five SIFTER subsets (academics, attention, communication, participation, and behavior) as well as the self-advocacy scores a discriminant analysis was performed as a multivariate analysis of variance. SIFTER TOTAL and SIFTER PLUS were not included as those variables are not independent from the individual subsets. The discriminant analysis was significant (Λ=0.73, χ^2=18.29, *df*=6, Canonical Correlation=0.52, *p*=.006). The "Good Student" function is named as such loads heavily on behavior, academic process, and self-advocacy, and communication. These features are name "good student" as they are often traits associated with more favorable treatment by teachers (Cameron & Cook, 2013; Kagan & Tippins, 1991).

School Factors

Introduction

This set of variables focuses on the number and size of schools attended by each group of children with MB/UHL. This variable reflects known difficulties associated with school size and school transfer for typically developing students (Gutman, Sameroff, & Cole, 2003). Fifty-nine parents provided information about the number of schools their children attended. Independent t-tests were conducted for the number of schools; whereas, crosstabulations were conducted for the size of the school. The number of preschools, elementary schools, middle and high schools were not significant (Table 41), but differences were observed in distributions of the number of schools attended by group. Differences in size were observed at elementary and middle school levels. The discriminant function on size and number variables was significant. All results are summarized in Table 8.

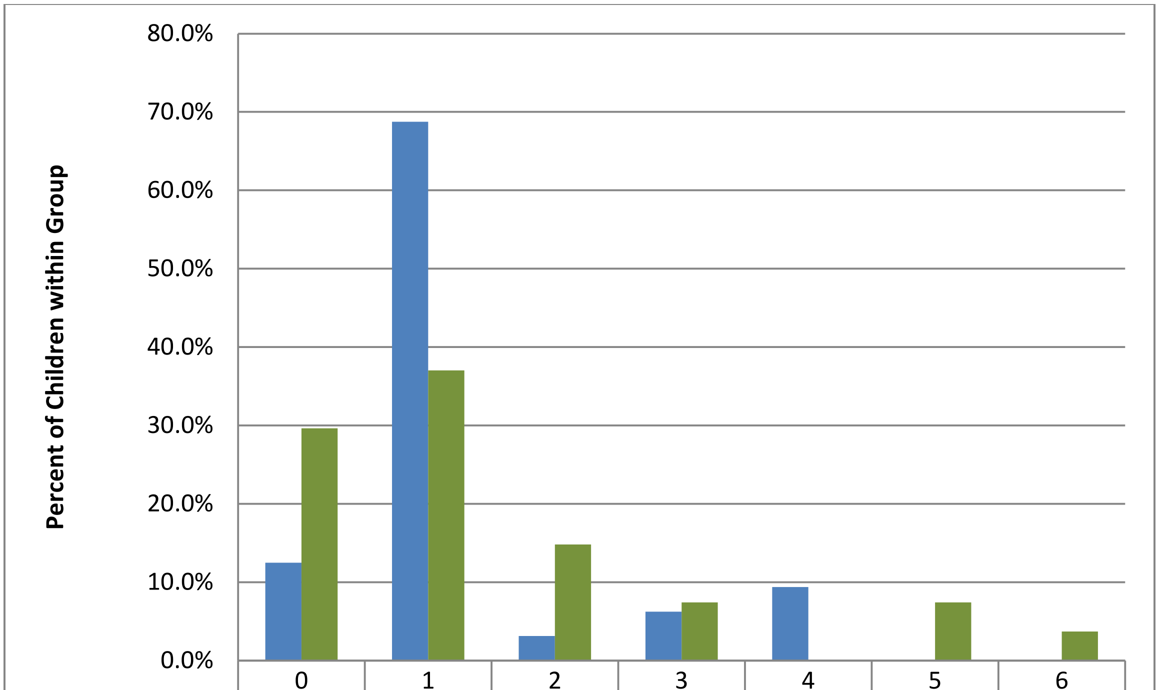
Descriptive: Number of Schools

Preschool. A total of 151 respondents provided information about the number of schools their child attended; of these participants 59 provided data on a majority of their schooling years (Successful: *N*=32; Failing: *N*=27). Small differences could be observed on histograms and descriptive statistics (see Figure 33 and Table 40). Successful students, on average attended 1.4 schools for preschool (*SD*=1.52, *SE*=0.68), 95% CI [-0.48, 3.28]. Histogram distribution shows that most successful students (66%) attended 1 preschool, with only 16% not attending preschool at all. Several successful students attended multiple preschools including 3% attending two schools, 6% attending three, and 9% attending four preschools.

Table 8

School Factors Summary

Question: Q45	How many schools has your child/student attended? Preschool; Kindergarten-Grade 5; Grade 6-8; High School 9-12				
Variable	**Type**	**Analysis**	**N**	**Results**	**Significant**
Pre-school	Scale	*t*-Test	59	*t*(57)=-0.55, *p*=..582, 95% CI [-0.92, 0.52], *r*=.07	
Elementary	Scale	*t*-Test	59	*t*(55)=-0.01, *p*=.99, 95% CI [-0.62, 0.61], *r*=.00	
Middle	Scale	*t*-Test	59	*t*(34)=-1.5, *p*=.144, 95% CI [-1.27, 0.19], *r*=.25	
High School	Scale	*t*-Test	151[*]	*t*(28)=-0.92, *p*=.745, 95% CI [-1.38, 0.52], *r*=.17	
Question: Q44	What size school did your child attend? (See Table 48 for Definition of school size) Preschool; Kindergarten-Grade 5; Grade 6-8; High School 9-12				
Variable	**Type**	**Analysis**	**N**	**Results**	**Significant**
Pre-school	Ordinal	Cross Tabulation/ Chi Square	30	(χ^2=5.22, *df*=3, *p*=.16)	
Elementary	Ordinal	Cross Tabulation/ Chi Square	228	(χ^2=11.56, *df*=4, *p*=.021)	Yes
Middle	Ordinal	Cross Tabulation/ Chi Square	116	(χ^2=9.83, *df*=3, *p*=.020)	
High School	Ordinal	Cross Tabulation/ Chi Square	65	(χ^2=3.95, *df*=4, *p*=.413)	
School Characteristics		Discriminant Analysis		Λ=0.55, χ^2=23.83, *df*=8, Canonical Correlation=0.670, *p*=.002	Yes

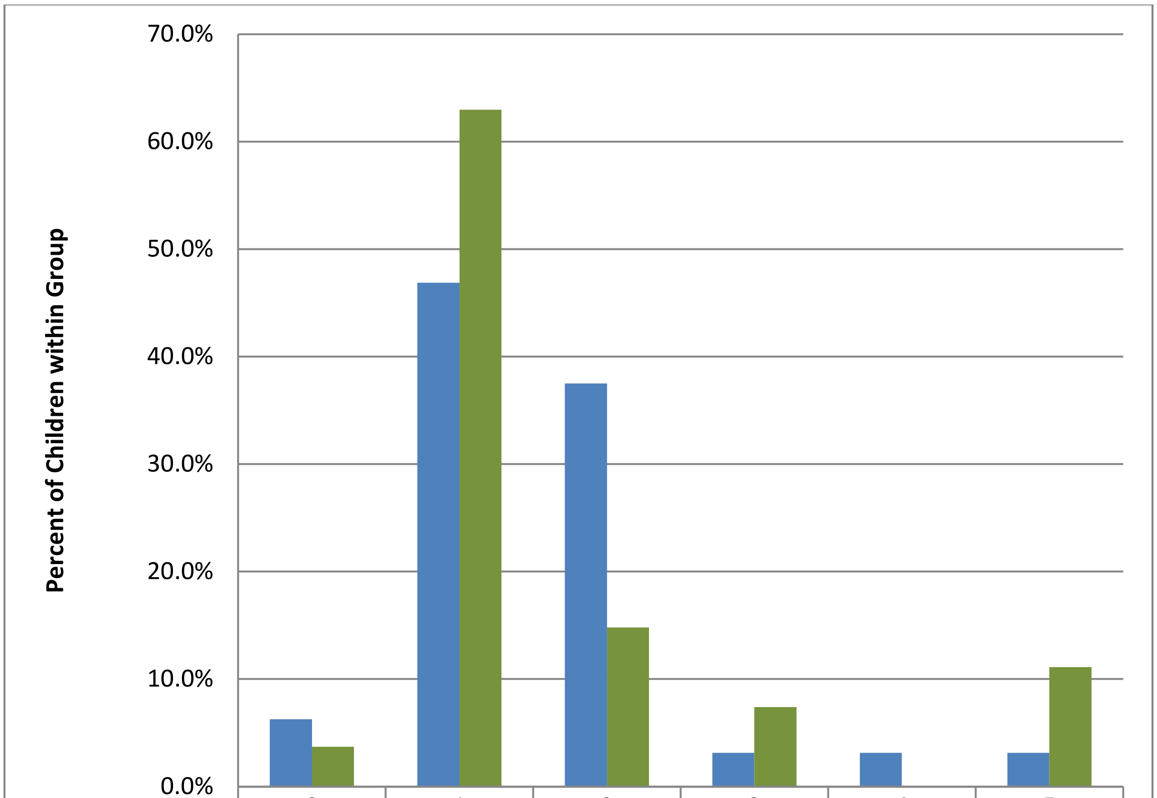


	0	1	2	3	4	5	6
1.0 Successful	12.5%	68.8%	3.1%	6.3%	9.4%	0.0%	0.0%
2.0 Failing	29.6%	37.0%	14.8%	7.4%	0.0%	7.4%	3.7%

Figure 33. Number of Preschools Attended. This figure illustrates the difference in the number of preschools attended by each group.

Children with MB/UHL who failed in school later showed different tendencies for preschool attendance than their successful peers. The average number of preschools attended by students who later failed was 3.3 (*SD*=2.25, *SE*=0.92), a number greater than their successful peers. Students who failed were less likely to ever attend preschool, with 30% never attending preschool. Attendance at one preschool only accounted for 37% of children. Thirteen percent of students who later failed academically attended 2 schools, 7% attended 3 schools, and 11% attended 5 or more preschools. There were no significant differences between groups for the number of preschools attended $t(57)=-0.55$, $p=.582$, 95% CI [-0.92,0.52], with a small effect size($r=.07$). Although the differences in average number of schools attended are not significant, there were differences in the number of schools attended that might be significant with larger sample size.

Elementary school. A total of 59 respondents provided information about the number of schools their child attended (Successful: *N*=32; Failing: *N*=27). Similar to the preschool attendance data, differences are able to be seen in the numbers of elementary school attended distribution patterns of histogram plots and through descriptive statistics (see Figure 34 and Table 40).

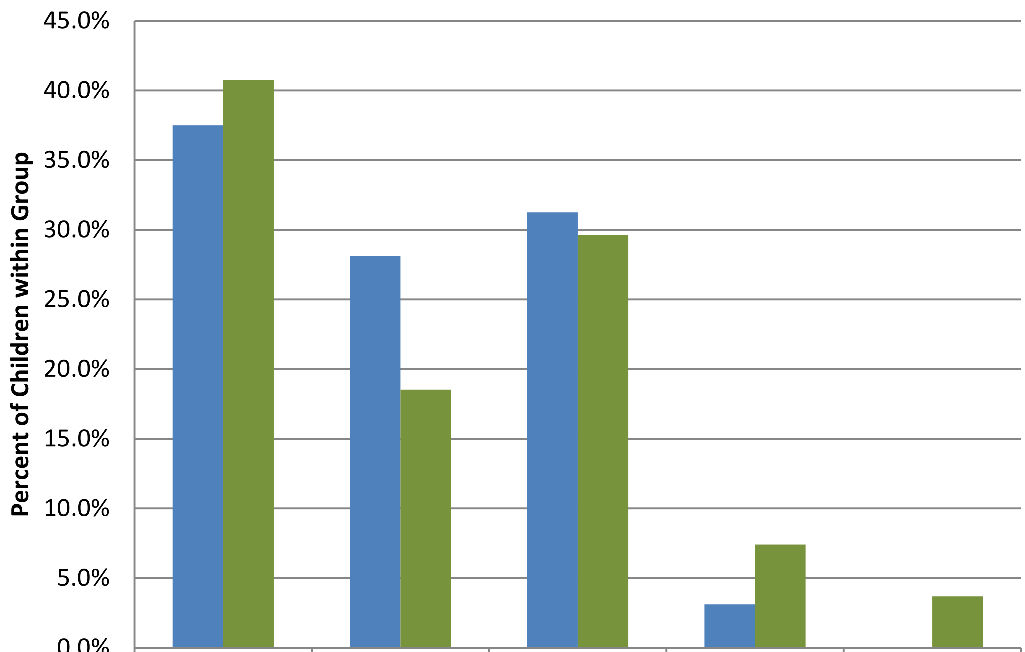


	0	1	2	3	4	5
1.0 Successful	6.3%	46.9%	37.5%	3.1%	3.1%	3.1%
2.0 Failing	3.7%	63.0%	14.8%	7.4%	0.0%	11.1%

Figure 34. Number of Elementary Schools Attended. This figure illustrates the difference in the number of elementary schools attended by each group.

The mean number of schools attended by successful students is 2 schools (*SD*=1.22, *SE*=0.55 95% CI [.48, 3.52]) and 3.33 (*SD*=1.97, *SE*=0.80, 95% [1.27, 5.4]) for failing students. Most students in the successful group (90%) and in the failing group (68%) attended one to two elementary schools. A higher percentage of students in the failing group attended three or more schools (19%) compared with that of their successful peers (10%), including 11% who attended five schools. As with preschools, no significant differences were observed in the number of elementary schools attended *t*(55)=-0.01, *p*=.990, 95% CI [-.62, .61], with a small effect size (*r*=0.002).

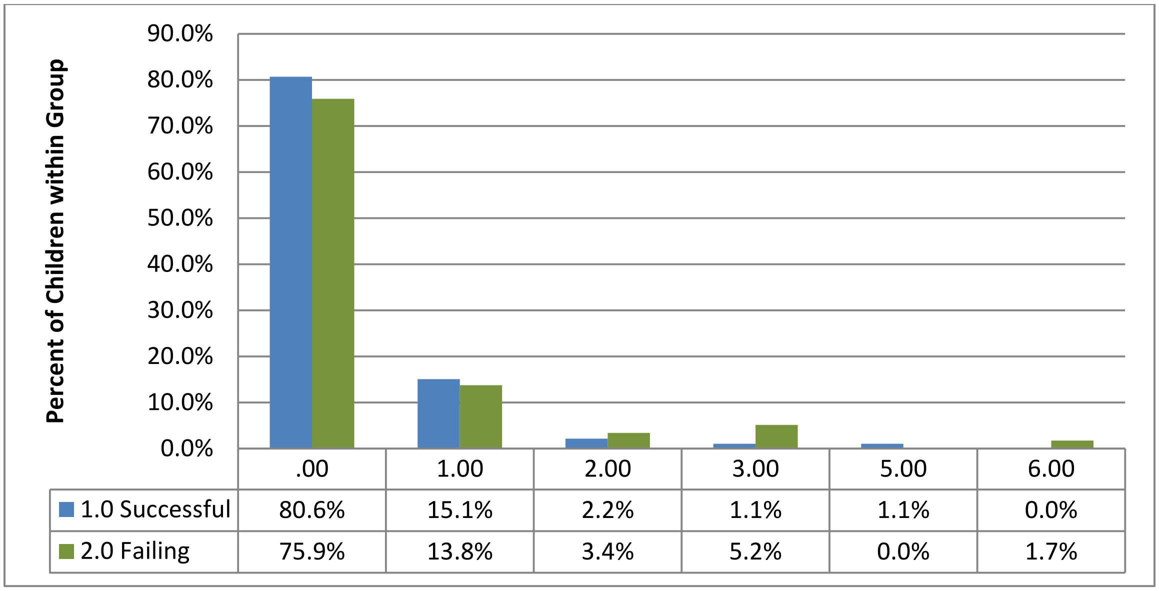
Middle school. A total of 59 respondents provided information about the number of schools their child attended (Successful: *N*=32; Failing: *N*=27). Middle school attendance also followed similar patterns to those of elementary schools (Figure 35 and Table 40). Most students in the successful group (95%) and failing group (81%) attended 1-2 schools. However, only 5% of successful students attended more than two schools; whereas, the results of the analysis of the responses of parents /guardians of failing students indicated that 19% of children attended four and six schools during their middle grade years. Although the mean for successful students (*M*=2.20, *SD*=1.09, *SE*=0.49, 95% CI [0.84, 3.56]) and failing students (3.0, *SD*=2.0, *SE*=0.82, 95% CI [0.90, 5.1]) did not differ statistically *t*(34)=-1.5, *p*=.144, 95% CI[-0.62, 0.61)], with a medium effect size (*r*=0.25), the impact of attending four or more schools over the course of three years should still be considered as a possible difference.



	.00	1.00	2.00	4.00	6.00
1.0 Successful	37.5%	28.1%	31.3%	3.1%	0.0%
2.0 Failing	40.7%	18.5%	29.6%	7.4%	3.7%

Figure 35. Number of Middle Schools Attended. This figure illustrates the difference in the number of middle schools attended by each group.

High school. A total of 151 respondents provided information about the number of schools their child attended (Successful: *N*=93; Failing: *N*=58). A majority of these children had not yet attended high school (*N*=119). Fewer of differences were observed in histogram distribution and descriptive statistics (Figure 36 and Table 40). Successful students on average attended 2.4 high schools (*SD*=1.67, *SE*=0.74, 95% CI [0.32, 4.47]); whereas, failing students attended 2.5 schools on average (*SD*=1.97, *SE*=0.81, 95% CI [0.427, 4.57]). Most students in successful and failing groups attended one or two high schools (88% and 71%, respectively). However, 29% of failing students attended three or more high schools; whereas, only 13% of successful students attended more than three high schools. The number of high schools attended was also not significantly different between groups of students with mild or unilateral hearing losses; $t(28)=-0.92$, $p=.745$, 95% CI [-1.38, 0.52], with a small effect size ($r=0.17$).



	.00	1.00	2.00	3.00	5.00	6.00
1.0 Successful	80.6%	15.1%	2.2%	1.1%	1.1%	0.0%
2.0 Failing	75.9%	13.8%	3.4%	5.2%	0.0%	1.7%

Figure 36. Number of High Schools Attended. This figure illustrates the difference in the number of high schools attended by each group.

Descriptive: Size of Schools

Parents were asked to rank the size of the schools their children attended as either very small, small, medium, large, very large based on the approximate number of students who attended that school. Between 30 and 228 respondents provided information on the size of schools their children attended. Like the number of schools attended, certain school levels had more complete data due to the fact that not all participants had completed the K-12 journey. Cross tabulations were calculated to determine if differences in mean scores were significant. Significant differences were observed in elementary size and middle school size.

Preschool. A total of 30 respondents provided information about the size of preschools their child attended. Differences in preschool size (Table 43) were not significant (χ^2=5.22, *df*=3, *p*=.157). The mean for successful students (2.8, *SD*=1.09, *SE*= 0. 49, 95% CI [1.43, 4.16]) indicates that most students attend small to medium sized preschool programs; whereas, the mean for failing students (2.1, *SD*=0.98, *SE*=0.401, 95% CI [1.13, 3.2]) indicates that most students attended small preschool programs, which can be visually affirmed in histogram distributions (see Figure 37).

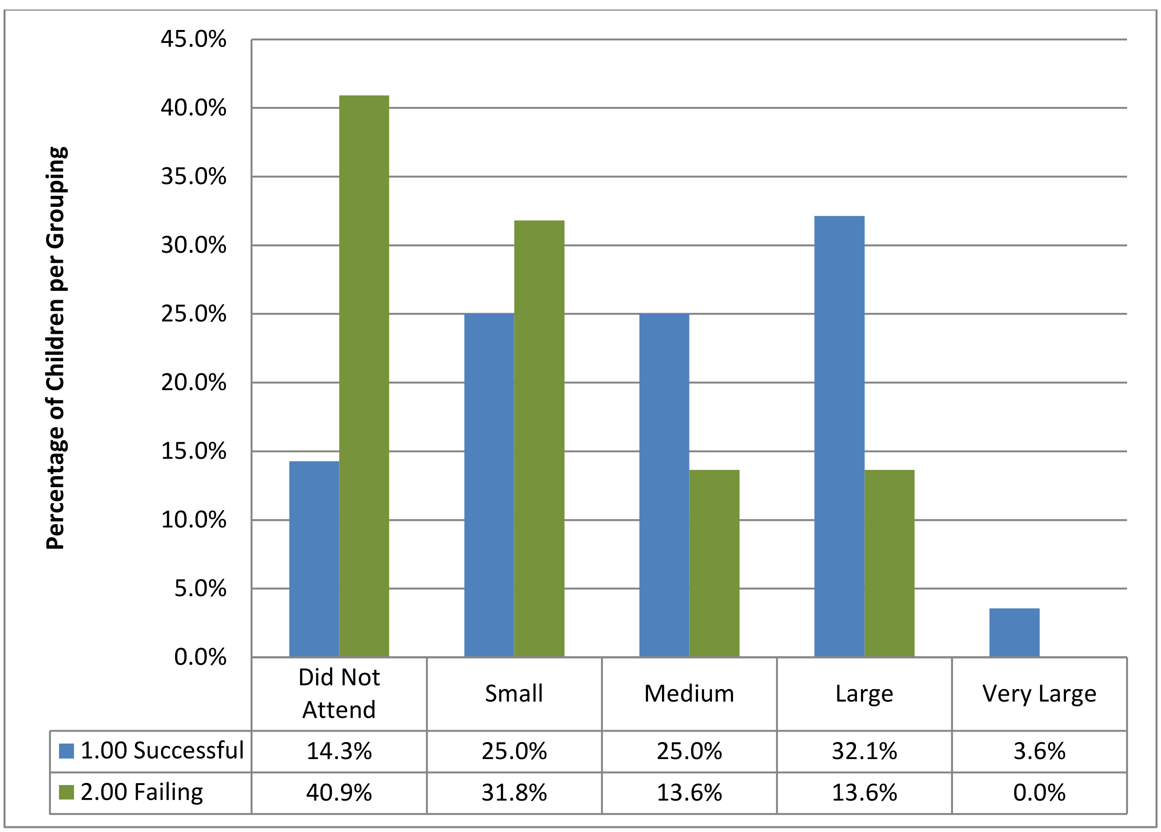
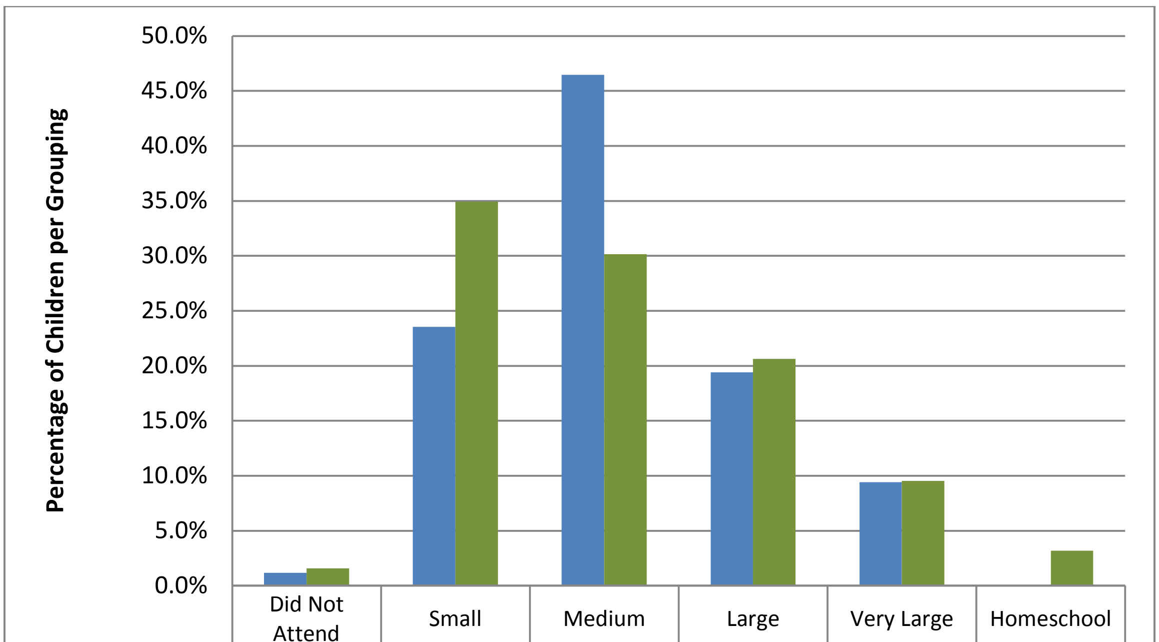


Figure 37. Size of Preschool Schools Attended. This figure illustrates the difference in the number of preschool schools attended by each group.

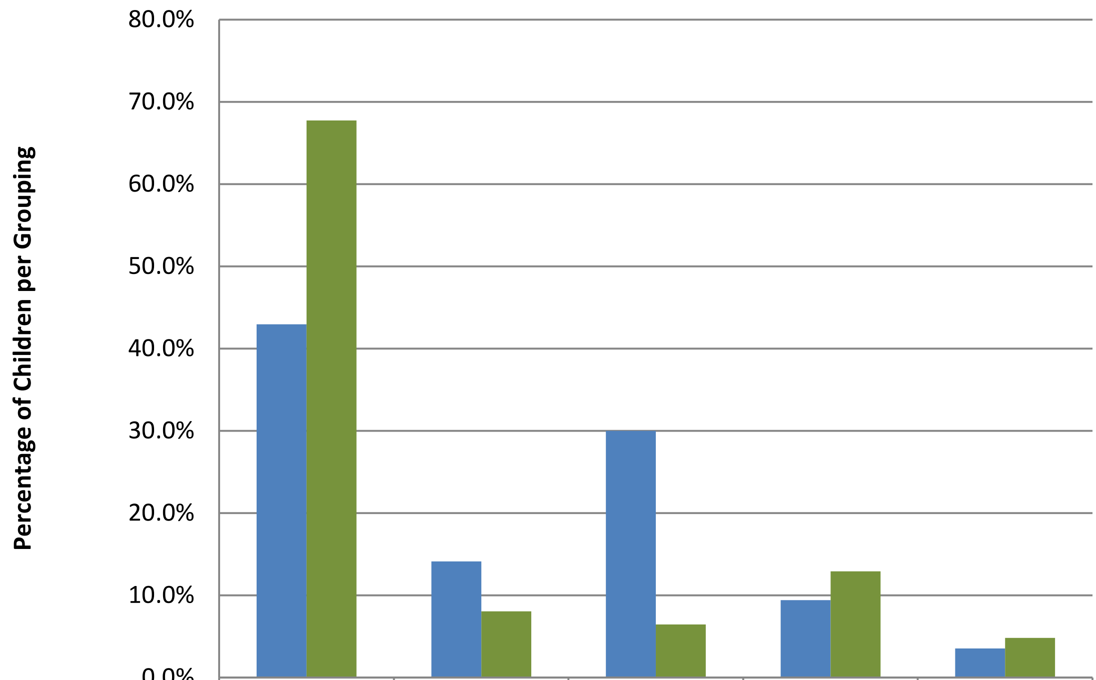
Elementary school. A total of 233 respondents provided information about the size of elementary schools their child attended (see Figure 38). Differences in elementary size were significant (χ^2=11.56, *df*=4, *p*=.021). The mean (3.2) for successful students (*SD*=0.45, *SE*=0.2, 95% CI [2.65, 3.76]) indicates that on average students attended medium sized elementary schools; whereas, the mean for failing students (2.8, *SD*=0.41, *SE*=0.17, 95% CI [2.41, 3.26]) indicates that most students attended small to medium elementary schools. Although mean values were very similar, more students in the failing group (13%) attended large or extra-large elementary schools than did successful peers (10%). Successful students also attended small or very small elementary schools slightly more frequently (70%) than their failing peers (65%).



	Did Not Attend	Small	Medium	Large	Very Large	Homeschool
1.00 Successful	1.2%	23.5%	46.5%	19.4%	9.4%	0.0%
2.00 Failing	1.6%	34.9%	30.2%	20.6%	9.5%	3.2%

Figure 38. Size of Elementary Schools Attended. This figure illustrates the difference in the number of elementary schools attended by each group.

Middle school. A total of 232 respondents provided information about the size of middle schools their child attended (Successful: *N*=170; Failing: *N*=62). Differences in middle school size were significant (χ^2=9.83, *df*=3, *p*=.020). The mean for successful students (3.2, *SD*=0.84, *SE*=0.37, 95% CI [2.16, 4.24]) indicates that on average students attended small to medium sized middle schools, as does the mean for failing students (3.16, *SD*=0.75, *SE*=0.31, 95% CI [2.38, 3.96]). See Figure 39.



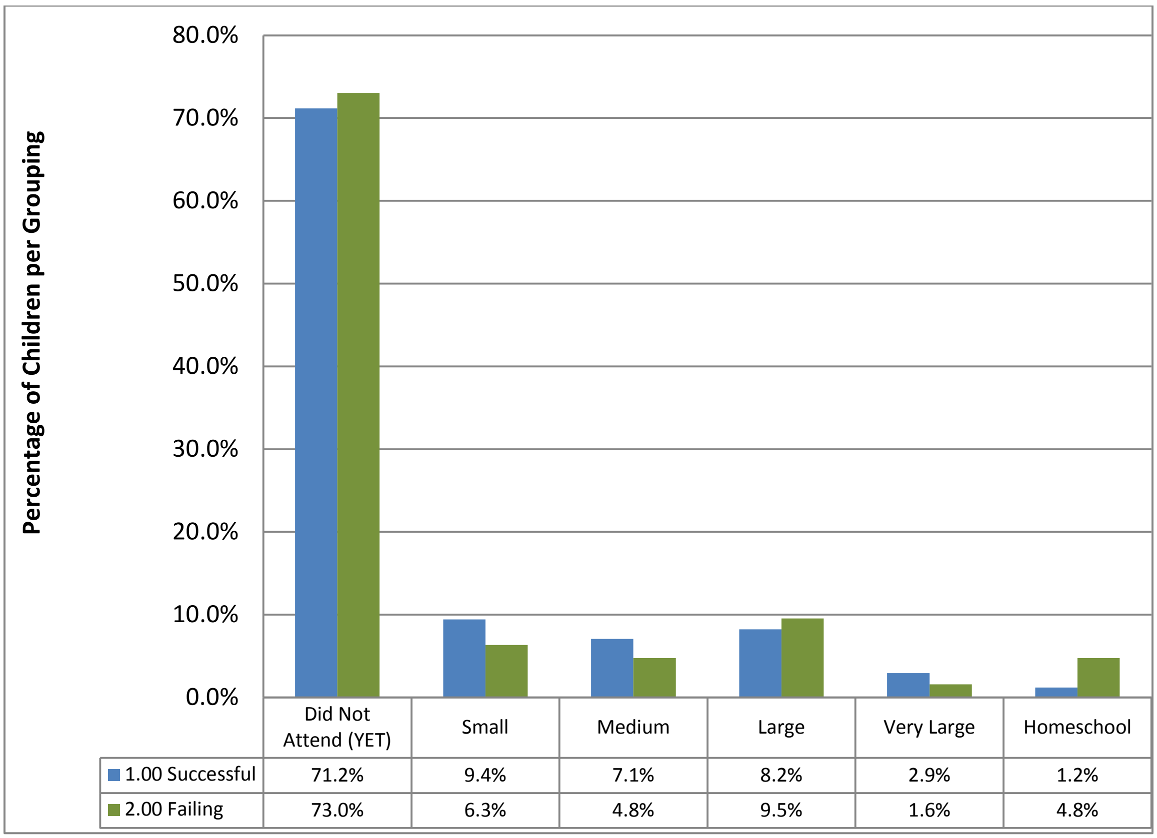
	Did Not Attend (YET)	Small	Medium	Large	Very Large
1.00 Successful	42.9%	14.1%	30.0%	9.4%	3.5%
2.00 Failing	67.7%	8.1%	6.5%	12.9%	4.8%

Figure 39. Size of Middle Schools Attended. This figure illustrates the difference in the number of middle schools attended by each group.

Although approximately the same percent of successful students (24%) and failing students (25%) attended very small middle schools, differences could be noted in the percentage to attend other sized schools. Twenty percent of failing students attended small middle schools compared with 53% of their successful peers. Medium schools were attended by 40% of failing students, but only 17% of successful students. Likewise, 15% of failing students attended large middle schools compared to only 6% of successful students. This distribution indicates that failing students more frequently attended medium to large schools; whereas, successful students were more frequently attending small and very small middle schools.

High school. A total of 233 respondents provided information about the size of high schools their child attended (Successful: *N*=170; Failing: *N*=63). Differences in high school size were not significant (χ^2=3.949, *df*=4, *p*=.413). The mean for successful students (4.0, *SD*=0.71, *SE*=0.32, 95% CI [3.12, 4.878]) indicates that most students attended large high school; whereas, the mean for failing students (3.67, *SD*=1.21, *SE*=.91, 95% CI [2.4, 4.94]) indicates that on average students attended medium to large preschools. By also looking at the distribution of histogram data, it can be observed that more successful students attended small or very small high schools (56%) compared to their failing peers (41%). Medium size schools were attended by 29% of successful students and 35% of failing students. Finally, large and extra-large schools were more frequently attended by failing students (23%) than their successful peers (15%). Simply stated, failing students more frequently attended schools that enrolled larger numbers of students. See Figure 40.

Discriminant analysis: School factors. A discriminant analysis was conducted using all variables for school size and number of schools attended. The discriminant analysis was significant (Λ=0.55, χ^2=23.83, *df*=8, Canonical Correlation=0.67, *p*=.002). The "Early Schooling" function loads heavily on the early school size (preschool).



	Did Not Attend (YET)	Small	Medium	Large	Very Large	Homeschool
1.00 Successful	71.2%	9.4%	7.1%	8.2%	2.9%	1.2%
2.00 Failing	73.0%	6.3%	4.8%	9.5%	1.6%	4.8%

Figure 40. Size of Preschool Schools Attended. This figure illustrates the difference in the number of preschool schools attended by each group.

Child and Family Demographics

Introduction

Characteristics both intrinsic and contextual/familial for a child have been shown to be predictors of success or risk of failure in the general population. Personal factors such as behavior, disability, gender, race, or ethnicity have been shown to influence at-risk standings for academic failure. Significant differences identified in this study included ethnicity and additional disabilities. Discriminant analysis for child factors was significant. A summary is provided in Table 9 with a full description to follow.

Child Demographics

Gender. Gender distributions indicate that 44% of the students with MB/UHL whose parents/guardians responded to the survey were male and 56% were female. One participant identified the student with MB/UHL as having another gender, accounting for less than 1% of the total participants. Approximately 45% of successful students were male and 41% of failing students were male. Approximately 55% of successful students were female and 59% of failing students were female. No significant differences were observed in gender between successful and unsuccessful students (χ^2=0.65, *df*=2, *p*=.724).

Race. Racial differences were not observed in this study (χ^2=.10.45, *df*=5, *p*=.062). Most respondents identified their children as Caucasian/white (67%) with 74% of those students categorized as successful. The next most frequent racial group African Decent/Black accounted for 27% of respondents, with 69% of those students identified as successful. Students who were identified as having Asian decent accounted for 2% of the population; within this group 83% were successful. One percent of students identified as Native American/Alaskan, all of whom were categorized as failing. Finally, 2% of the population identified as either multiracial or of another race. 66% of these students were successful. See Figure 41.

Table 9

Child Characteristics Summary

Variable	Type	Analysis	N	Results	Significant
Question: Q50		My child with hearing loss is: Male, Female, Transgender/Multigender, Other			
Variable	**Type**	**Analysis**	**N**	**Results**	**Significant**
Gender	Categorical	Cross-Tabulation/ Chi Square	249	(χ2=.65, df=2, p=.724)	
Question: Q49		What is the child/student's race? White/ Caucasian; Black or African American; American Indian or Alaska Native; Asian; Native Hawaiian or Other Pacific Islander; Multiracial ; Other; Prefer not to respond			
Variable	**Type**	**Analysis**	**N**	**Results**	**Significant**
Race	Categorical	Cross-Tabulation/ Chi Square	249	(χ2=10.45, df=5, p=.063)	
Question: Q49		What ethnicity is the child/student? Hispanic/Latino(a); Non-Hispanic/Latino(a); Other			
Variable	**Type**	**Analysis**	**N**	**Results**	**Significant**
Ethnicity	Categorical	Cross-Tabulation/ Chi Square	249	(χ2=.7.74, df=2, p=.021)	Yes
Question: Q68/ Q78		Does your child have additional disabilities to hearing loss? What?			
Variable	**Type**	**Analysis**	**N**	**Results**	**Significant**
Additional Disabilities	Categorical	Cross-Tabulation/ Chi Square	249	(χ2=37.21., df=1, p=.000)	
Child Characteristics	Multiple-Factor	Discriminant Analysis	249	(Λ=.84, χ2=41.94, df=4, Canonical Correlation=0.397, p=.000)	Yes

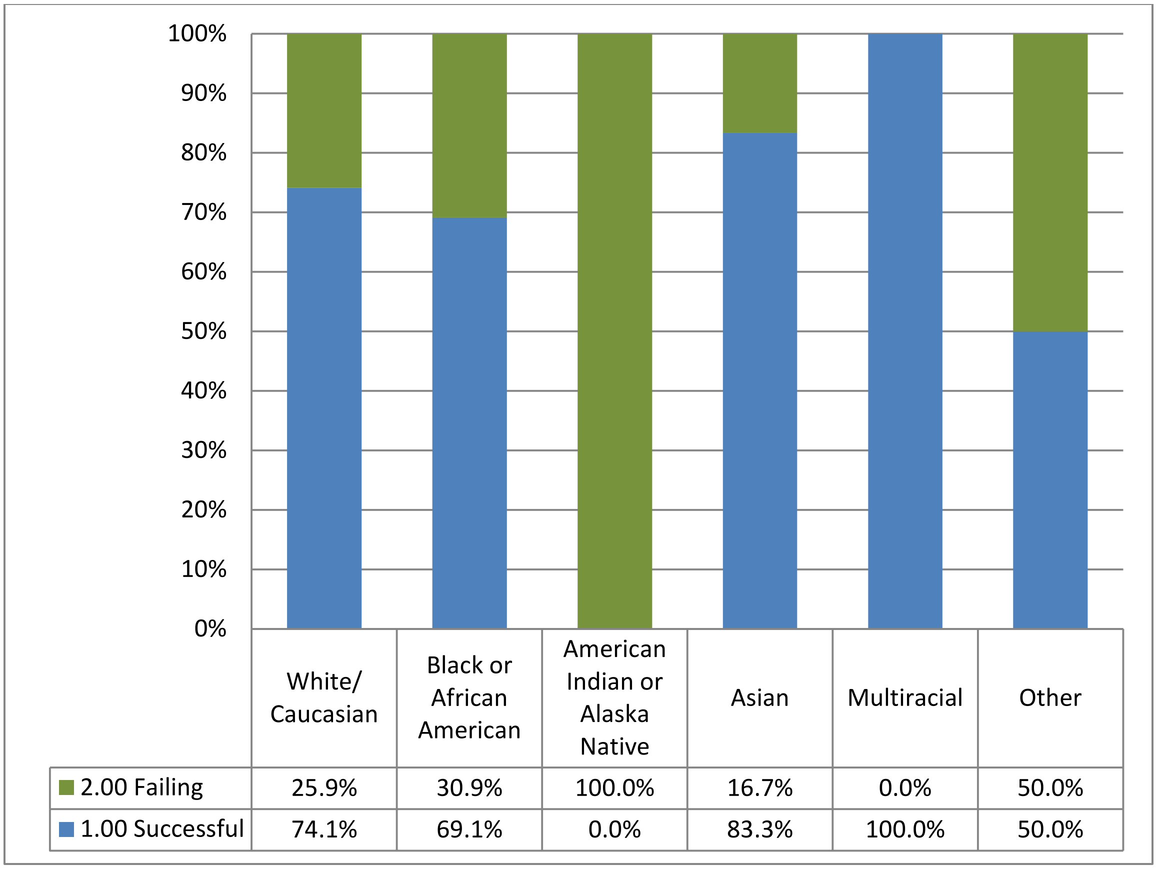


Figure 41. Representation of Race by Group. This figure illustrates the distribution of race identity of the overall percentage of participants.

Ethnicity. Families were asked to choose one of three ethnicity categories: Hispanic/Latino, Non-Hispanic/Latino, or Other. Of those who responded, 4% indicated Hispanic/Latino ethnic identity, 95% identified as Non-Hispanic, 1% indicated other identity. Significant differences between groups by ethnic identity were observed (χ^2=.7.74, *df*=2, *p*=.021). Within those students identified as Hispanic, 64% had failed academically, where only 26% of Non-Hispanic students had failed academically. See Figure 42.

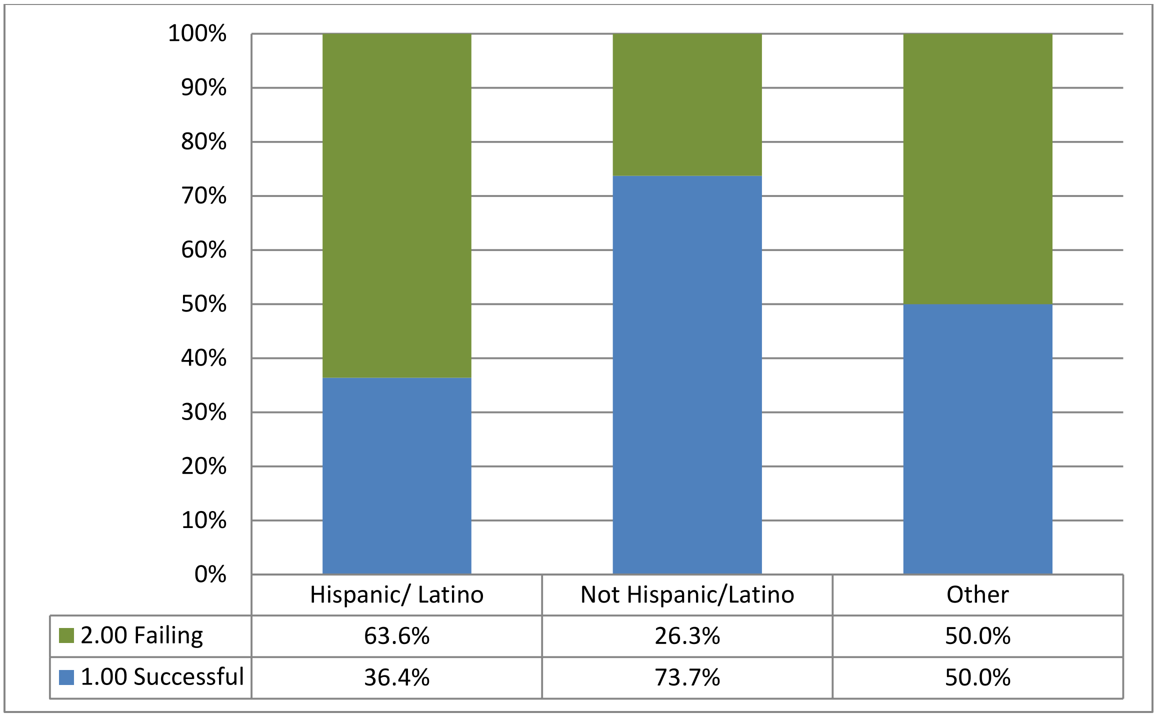


Figure 42. Representation of Ethnicity by Group. This figure illustrates the distribution of ethnicity identity of the overall percentage of participants.

Additional disability. Parents and guardians were asked to identify if their children had additional disabilities. Students with additional disabilities represented 12% of the 249 respondents. Of those who had additional disabilities, 74% failed academically. For students with only mild bilateral or unilateral hearing loss, only 22% failed academically. This difference in academic success is significant (χ^2=37.21, *df*=1, *p*=.000). Other disabilities indicated include: Asperger's Syndrome, idiopathic central diabetes insipidus, Attention Deficit (ADD/ADHD), Auditory Sensory Integration Disorder/ Sensory Processing Disorder, Pervasive Developmental Disorder (Not Otherwise Specified/NOS), Autism, Down's Syndrome, Specific Language Disorder, Learning Disability (Math), and Learning Disability (Reading). See Figure 43.

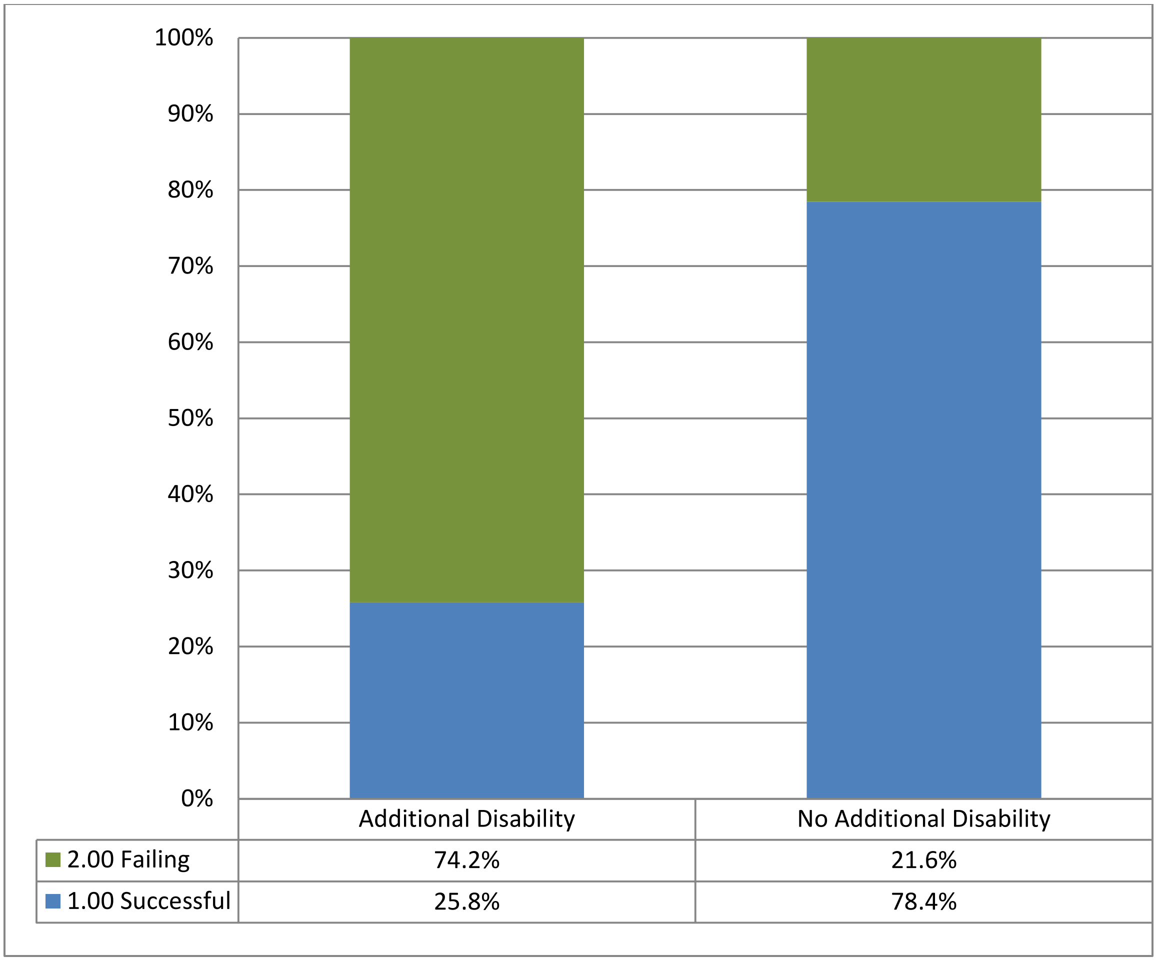


Figure 43. Representation of Additional Disability by Group. This figure illustrates presence of additional disability within the overall percentage of participants.

Using these four factors (gender, race, ethnicity, additional disability), a discriminant analysis was conducted. The significant function (Λ=0.84, χ^2=41.94, *df*=4, Canonical Correlation=0.397, *p*=.000), renamed "Twice Marginalized" loads heavily on additional disability as well as ethnicity and is named as such due to the likelihood of both of these categories resulting in higher rates of academic failure independently.

Family Demographics

Risk factors associated with family demographics were examined based on past trends in the literature (Kominski, 2000). These factors include home language, income, household setting, community type, household size, and education level of parents. Two variables were significant; mother's educational level and secondary home language. The discriminant analysis was not significant. A summary of the results can be found in Table 10, with a full description of results to follow.

Home language. Most families (92%) reported their primary language as English (see Figure 44). One respondent reported a primary language of Chinese, French, Vietnamese, American Sign Language (ASL), and Hmong. Secondary languages were not present in 90% of homes. Other secondary languages included English (3%), Spanish (1%), Chinese (0.4%), ASL (4%), Pidgin Sign Language (0.8%), and Punjabi (0.4%). Significant differences were not observed in primary languages (χ^2=5.39, *df*=5, *p*=.370). Children whose primary languages were of Asiatic nations (Hmong, Chinese, and Vietnamese) were only seen in the failing group. Secondary languages spoken at home were significant (χ^2=13.65, *df*=5, *p*=.018). Children having only one language at home were more likely to be successful (75%) than failing (25%). Children using English as a secondary home language had 50% representation in the failing category. Of children with Spanish as their secondary language 67% showed academic failure, and 60% of secondary ASL users failed academically. This finding may indicate a discrepancy between the languages of school and home.

Table 10

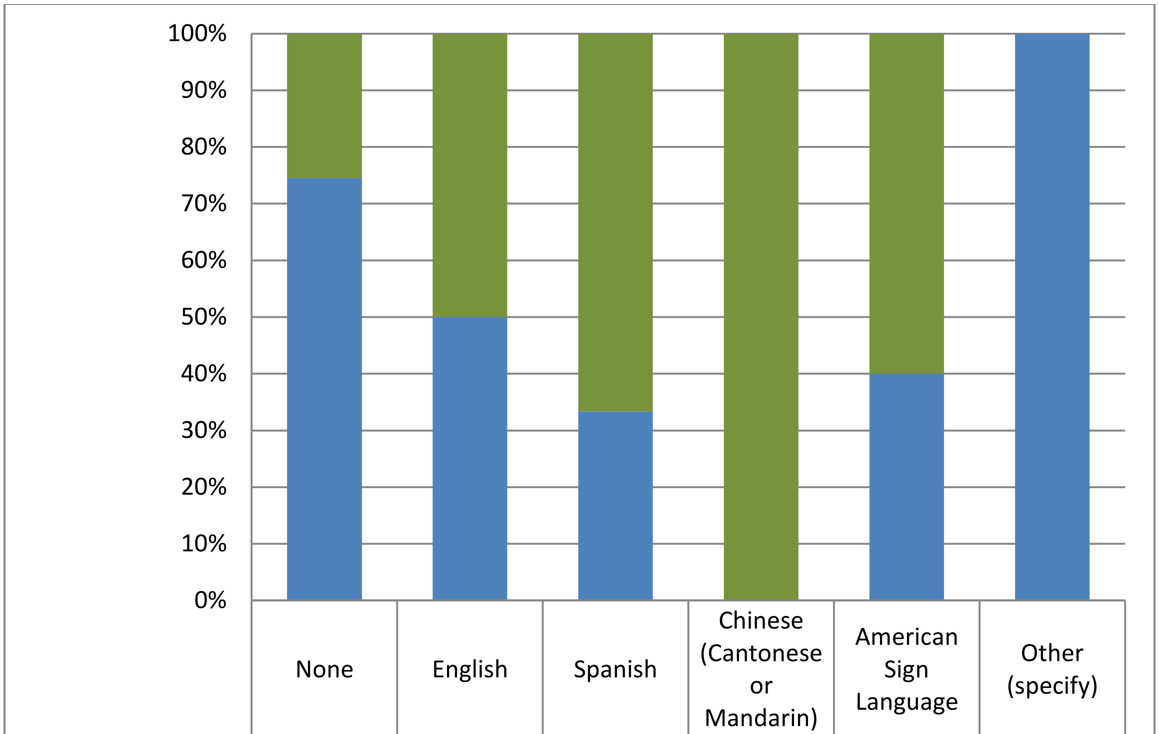
Family Characteristics Summary

Question: Q1/ Q60		What is the language spoken in your home (i.e., the one you speak most of the time)? English ;Spanish; Chinese (Cantonese or Mandarin);French; Vietnamese; Arabic; Japanese; Tagalog; American Sign Language; Signed Exact English; Other ____________________			
Variable	**Type**	**Analysis**	**N**	**Results**	**Significant**
Primary	Categorical	Cross-Tabulation/ Chi Square	63	(χ^2=5.39., *df*=5, *p*=.370)	
Secondary	Categorical	Cross-Tabulation/ Chi Square	249	(χ^2=13.65., *df*=5, *p*=.018)	Yes
Question: Q9		Please indicate the current household income in U.S. dollars in which the child/student with hearing loss dwells. Rather not say; Under $10,000; $10,000 - $19,999; $20,000 - $29,999; $30,000 - $39,999; $40,000 - $49,999; $50,000 - $74,999; $75,000 - $99,999; $100,000 - $150,000; Over $150,000			
Variable	**Type**	**Analysis**	**N**	**Results**	**Significant**
Income	Interval	*t*-test	63	*t*(61)=.20, *p*=.841, 95%CI [-1.41, 1.71], *r*=.78	
Question: Q5		What is the household setting where the child primary resides? Two Parent Family; Single Parent; Widowed Parent; Blended Family (combined family/step family); Multiple Generation Family (Grandparents, Parents, Children); Foster Care; Group Home; Other ; Rather not say			
Variable	**Type**	**Analysis**	**N**	**Results**	**Significant**
Household Setting	Categorical	Cross-Tabulation/ Chi Square	63	(χ^2=10.69, *df*=6, *p*=.099)	
Question: Q7		In which community setting do you reside? Urban, Suburban, Town, Rural			
Variable	**Type**	**Analysis**	**N**	**Results**	**Significant**
Community	Categorical	Cross-Tabulation/ Chi Square	63	(χ^2=6.74., *df*=3, *p*=.081)	

Table 10

(Cont.)

Question: Q8		How many adults AND children live in your household?			
Variable	**Type**	**Analysis**	**N**	**Results**	**Significant**
Household Size	Scale	*t*-test	63	*t*(61)=.88, *p*=.383, 95% CI [-0.28, 0.73], *r*=.25	
Question: Q38/ Q3		What is the highest level of education of the parents of the child?			
Variable	**Type**	**Analysis**	**N**	**Results**	**Significant**
Mother	Ordinal	*t*-test	63	*t*(61)=2.10, *p*=.039, 95% CI [.06, 2.16], *r*=.53	Yes
Father	Ordinal	*t*-test	63	*t*(61)=-.25, *p*=.801, 95% CI [-.89, 1.14], *r*=.51	
Family Characteristics	Multiple-Factor	Discriminant Analysis	179	(Λ=.87, χ^2=8.28, *df*=8, Canonical Correlation=0.37, *p*=.407)	Yes



	None	English	Spanish	Chinese (Cantonese or Mandarin)	American Sign Language	Other (specify)
2.00 Failing	25.4%	50.0%	66.7%	100.0%	60.0%	0.0%
1.00 Successful	74.6%	50.0%	33.3%	0.0%	40.0%	100.0%

Figure 44. Secondary Home Languages, Percentage of Language. This figure illustrates the secondary language spoken by families within the overall group.

Income. Only 63 participants provided household income information. Of those participants, children in families of household incomes under $50,000 annually 80% failed academically; whereas, children in families with incomes over $50,000 annually had a 37% failure rate. Both of these values are above the failure rates of typically developing students (Child Trend, 2013) but are not significant differences between groups (χ^2=13.79, *df*=8, *p*=.087). More students (72%) were represented in the above $50,000 income bracket, possibly indicating a recruitment representation flaw.

Household setting and size. Of the families who responded to family characteristics, most families (76%) of the 63 described, were two-parent families, which is a higher percentage than the national average of 68% (Statistics, 2013). Single-parent families (including widowed, separation, choice, and adoptive) accounted for 6% of the surveyed participants; whereas, the national average is 28%. Blended families or families with step-parents/siblings, represented 6% of surveyed participants; this percentage is less than the national average of 8%. National average (Taylor et al., 2010) indicates that multiple generation households typically account for 16% of families, in this study, only 3% of participants had children living in multigenerational families (see Figure 45).

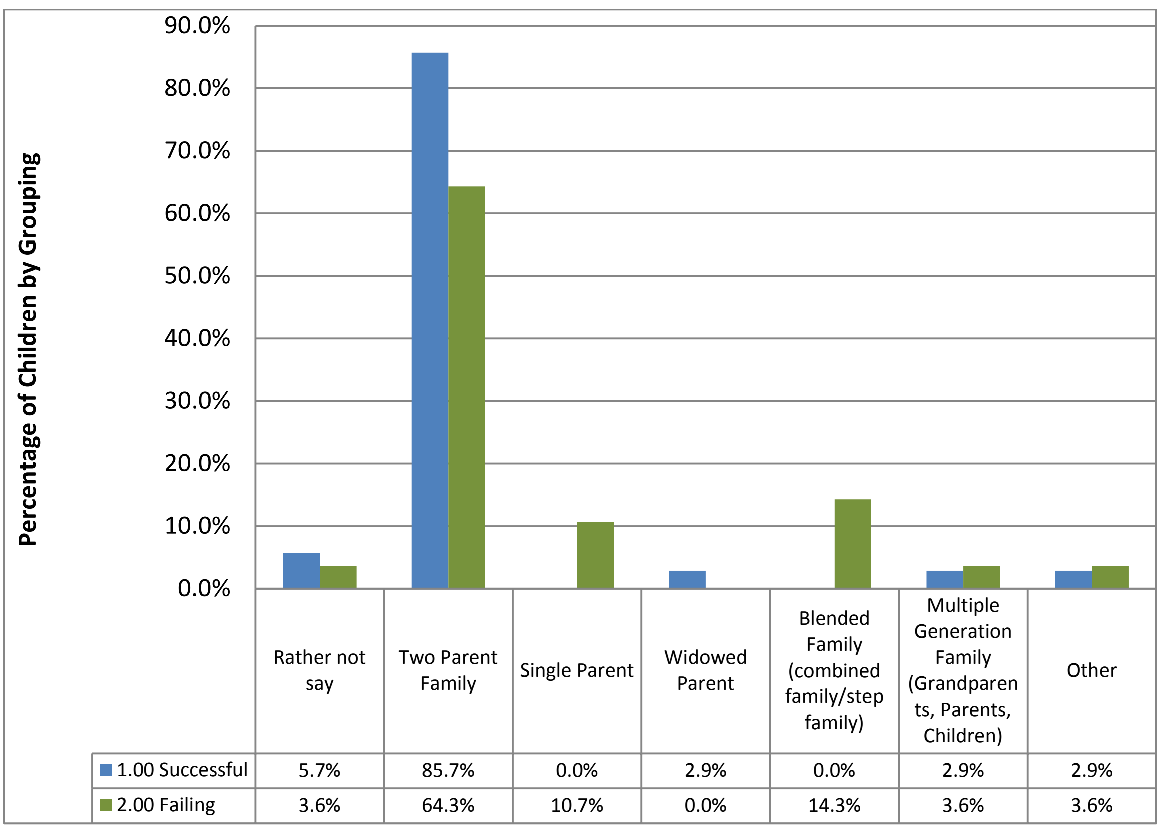


Figure 45. Household Setting by Group. This figure compares the household settings for children by group.

Settings in which families evidenced a greater percentage of successful students than failing students included only two parent families (63%). Single parent and multi-generational families each had all of their children identified as failing. Blended families had an equal representation of students who were classified as successful and failing academically. The differences were not significant (χ^2=10.69, *df*=6, *p*=.099).

Most children resided in households of four people, including adults and children in both groups. Children who failed were more frequently living in a two-person household than their successful peers, however other sizes of family (3-6 people) were fairly similar. The differences in number of persons in household, *t*(61)=0.88, *p*=.383, 95% CI [-.282, .725], with a small effect size (*r*=0.25) were not significant. See Figure 46.

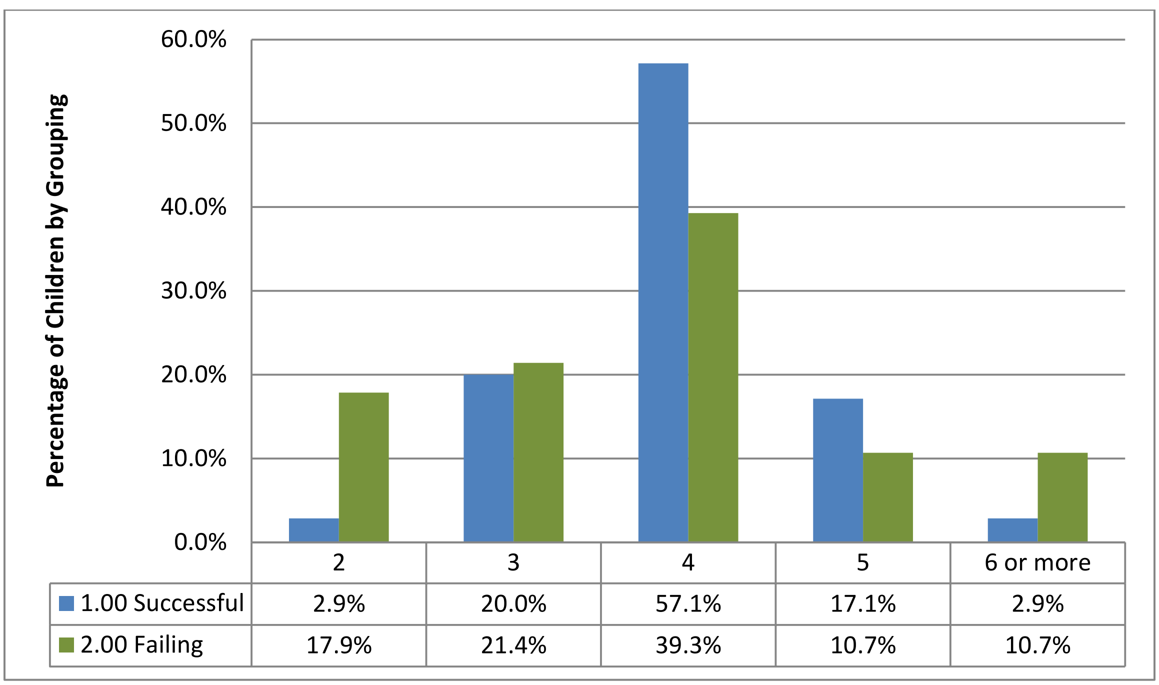
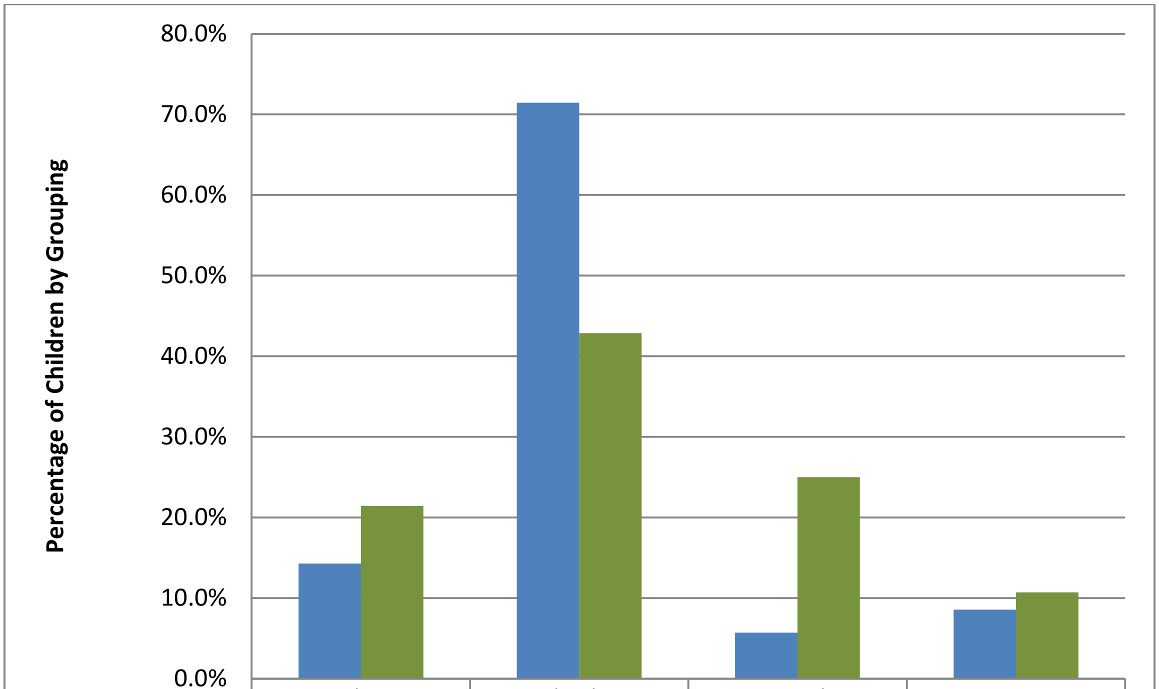


Figure 46. Household Size by Group. This figure illustrates the size of households (adults and children) by group.

Community type. Participants were asked to describe the community setting in which their children lived as either urban, suburban, town, or rural (see Figure 47). Parents/caregivers who lived in rural and urban settings showed more students failing than displaying successful academic performance; 46% of children in urban settings failed in academic performance and 78% of rural students with MB/UHL failed academically. In town settings, children were equally represented in successful and failing groups. In suburban settings, 32% of children with MB/UHL failed academically. More students were living in suburban settings than other settings, possibly paralleling family income levels. These differences were not significant (χ^2=6.74, *df*=3, *p*=.081).



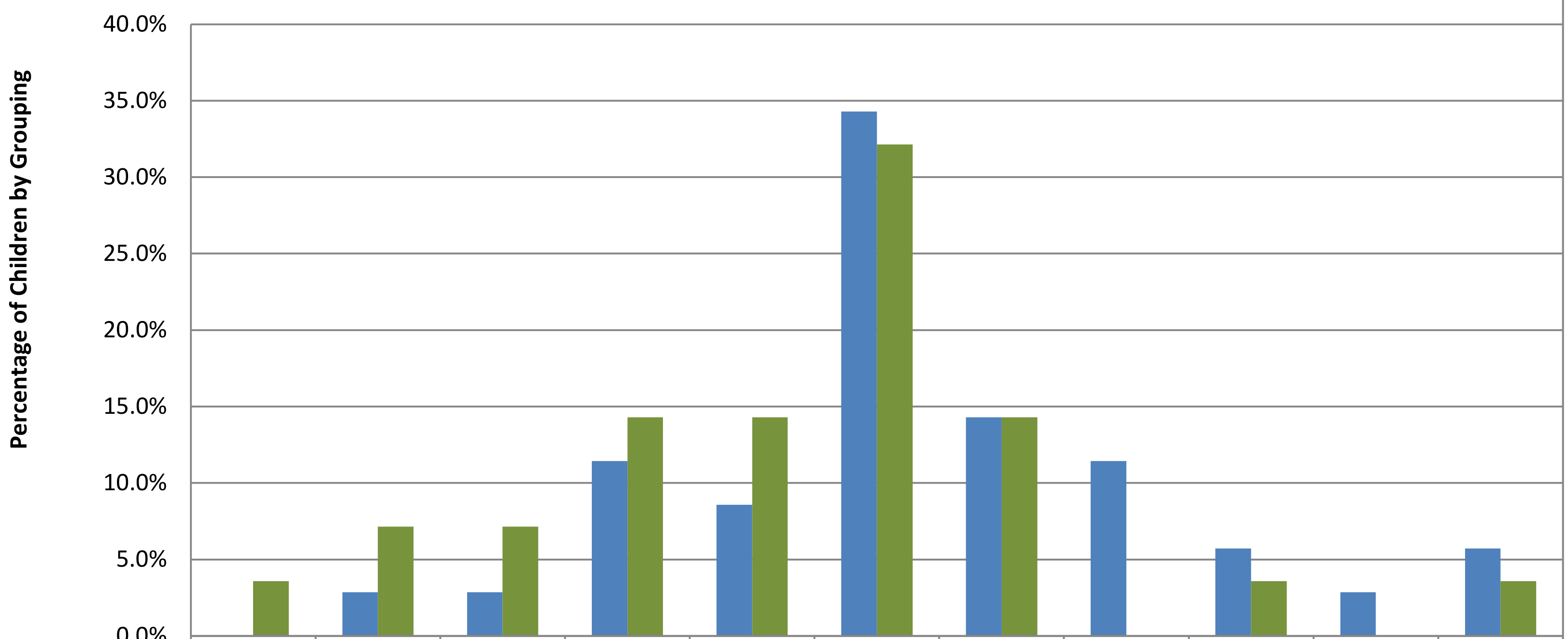
	Urban	Suburban	Rural	Town
1.00 Successful	14.3%	71.4%	5.7%	8.6%
2.00 Failing	21.4%	42.9%	25.0%	10.7%

Figure 47. Community Type. This figure compares the community setting of groups of children with MB/UHL who are successful (1.0) and failing (2.0).

Mother and father educational level. Mother's educational level most frequently appearing in both groups consisted of their attaining a 4-year degree. Twenty-seven percent of mothers of successful children had less than a four-year degree; whereas, 46% of mothers of failing students had less than a four-year degree. A 4-year college degree was obtained by 35% of mothers of successful students and by 21% of mothers of failing students. Advanced degrees were obtained by 38% of mothers of successful children and 21% of mothers of failing students. Thus, mothers of successful children had higher educational levels. These differences were significant $t(61)=2.10$, $p=.039$, 95% CI [.06, 2.16], $r=.53$. See Figure 48.

Father's educational level most frequently appearing in both groups consisted of a 4-year degree. Forty-four percent of fathers of successful children had less than a four-year degree; whereas, 48% of fathers of failing students had less than a 4 year degree. A 4-year college degree was obtained by 29% of fathers of successful children and 30% of fathers of failing students. Advanced degrees were obtained by 27% of fathers of successful children and 22% of fathers of failing students. Fathers of successful and failing students had similar educational levels across educational levels. These differences were not significant $t(61)=-.25$, $p=.801$, 95% CI [-.89, 1.14], $r=.51$. See Figure 49.

Discriminant analysis: Family characteristics. Using these factors (mother and father educational level, family size, family setting and size, community setting, income, and language), a discriminant analysis was conducted. The non-significant function ($\Lambda=0.87$, $\chi^2=8.281$, $df=8$, Canonical Correlation=0.37, $p=.407$).



	Grammar School (K-8)	High School or equivalent	Career Training/ Trade School (Certificate only)	Vocational/Technical/Community College (Associate Degree)	Some College	College Graduate (4 year)	Master's Degree	Doctoral Degree (PhD)	Professional Degree (MD, JD, etc.)	Unknown	Other
1.00 Successful	0.0%	2.9%	2.9%	11.4%	8.6%	34.3%	14.3%	11.4%	5.7%	2.9%	5.7%
2.00 Failing	3.6%	7.1%	7.1%	14.3%	14.3%	32.1%	14.3%	0.0%	3.6%	0.0%	3.6%

Figure 48. Mother's Education Level by Group. This figure illustrates the educational level of the mother of the child with hearing loss.

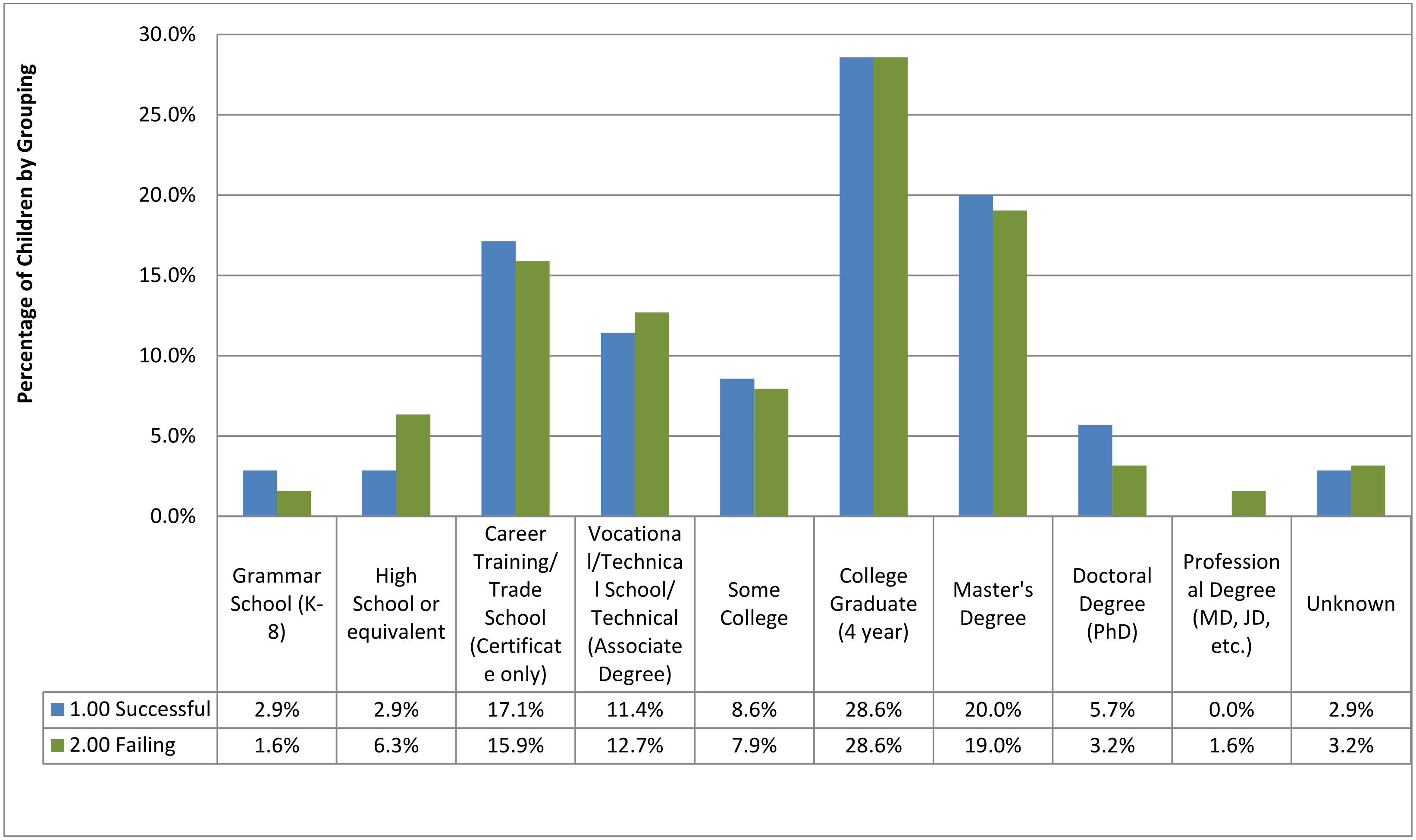


Figure 49. Father’s Education Level by Group. This figure illustrates the educational level of the father of the child with hearing loss.

Summary

Chapter 4 provides details on the statistical analyses conducted during this study. These findings, reiterated below, are further interpreted in Chapter 5 which discusses the context of such findings for practice and future research.

Summary of Univariate Results

- *Audiological results* indicate significant differences between groups in the pure tone averages and articulation indexes of children with MB/UHL, specifically for the left ear. Significant differences were observed at 250Hz, 1000Hz, and 4000 Hz.
- *Services provision* results indicate differences between groups in early intervention provision, classroom amplification usage (past and present), personal amplification (past and present), specialized education service provision, and modifications to educational delivery.
- *Child Demographics* results indicate difference between groups based on ethnicity and additional presence of disability.
- *Family Demographics* results indicate differences between groups based on mother's educational level and family languages(s).
- *SIFTER Scores* indicate differences between groups on academics, communication ability, and behavior scores.
- *School Characteristics* indicate differences in groups because of size of elementary and middle schools.

Summary of Multivariate Results

- *Audiological*—discriminant analysis was not significant.
- *Services*—discriminant analysis was not significant.
- *Child Demographics*—discriminant analysis was significant. Model loaded heavily on additional disability.
- *Family Demographics*—discriminant analysis was significant. Model loaded heavily on mother's educational level and household composition.
- *SIFTER Scores*—discriminant analysis was not significant. Model loads heavily on behavior, academic process, and self-advocacy, and communication.
- *School Characteristics*—discriminant analysis was significant. Model loaded heavily on number of schools (ES, MS, HS) and size of schools (PK, MS, HS).

CHAPTER V

DISCUSSION

Introduction

This survey study was designed as an exploratory tool into the characteristics of children who have mild bilateral or unilateral hearing loss in order to better understand which children are at risk for academic failure. Although multiple studies have identified areas of risk for children with mild or unilateral hearing loss (Ching et al., 2013; Kuppler, Lewis, & Evans, 2013; Yelverton et al., 2013), none of these have defined which students are more likely to have negative outcomes. In order to identify possible risks, a survey was conducted to describe the academic experiences, demographics, and treatment of hearing loss. Both univariate and multivariate methods were used for analysis.

Risk factors for the general population and risk factors for children with hearing loss were included in this study as both relate directly to the assumption that children with mild bilateral hearing loss are neither fully defined by the risk factors of the general population, nor by the risk factors of children with hearing loss. This hints back at the theoretical framework that states that children with MB/UHL are neither hearing nor Deaf, and are therefore marginalized by a lack of belonging. Like children of mixed cultures, races, religions, etc., children who are hard of hearing are not recognized fully recognized as Deaf nor do they function as fully hearing, though they often are considered hearing by professionals working with them. This chapter will reflect back to this concept of un-categorization as a persistent problem facing the service provision of hearing-specific services to children with mild bilateral or unilateral hearing loss.

Chapter 5 will present a discussion of results by grouping of variables (audiological, school factors, parent perceptions, child characteristics, and identification factors). Next, it will connect past research studies to current research studies. Third, this chapter will return to analyze the impact of "in between" status as a classification. Finally, this chapter will present recommendations including future recommendations for research, limitations, and discussion of other relevant studies.

Summary of the Results

Six areas were examined for individual elements of audiological factors, identification factors, child characteristics, family characteristics, school characteristics, and parent perceptions. Twenty-one areas were significant through univariate methods and twenty-six were not. Results are summarized in Table 4. Additionally, multivariate methods were used to examine these factors as units. Three areas were found to be significantly different between groups: school, family, and child characteristics.

Discussion of Results

Overall Results

Past research indicated a higher failure rate of students with MB/UHL than what this study found. While this could be good news for the parents/families of children with MB/UHL, it should be taken with caution as the participation of survey takers was on a voluntary basis and not necessarily representative of the overall population of children with MB/UHL. On the other hand, it could indicate that because of earlier interventions and amplification, the impact of mild or unilateral hearing loss is lessened. What is known is that these children continue to fail academically at a higher rate than their hearing peers and therefore need continued consideration into the unique needs for learning and language development.

The null hypothesis for this study indicated that it was predicted that no differences occur between successful groups of students with MB/UHL and students who failed academically with MB/UHL. However, the factors that were chosen to examine, were chosen based on past research students that indicates that the trend may be otherwise. It is a confusing situation to many that the hypothesis is no difference, but the expectation was a difference—a truth behind hypothesis testing. In short, several expectations were likely to be true based on these past research studies; those expectations are defined as the alternative hypothesis.

Audiological

Significant results were found for the life at right ear at 250Hz, 1000Hz, and 4000Hz. Additionally, left Articulation Index and Pure Tone Average were significant. The significant results at 250Hz are surprising, as most frequently cited for detriment to speech intelligibility are the higher frequencies (>2000Hz). However, when examining the articulation index in conjunction with the significant frequencies (see Figure 50) 250Hz is more sensitive to lower degrees of hearing loss (10dB) while other frequencies are not sensitive to hearing loss until the 20dB range.

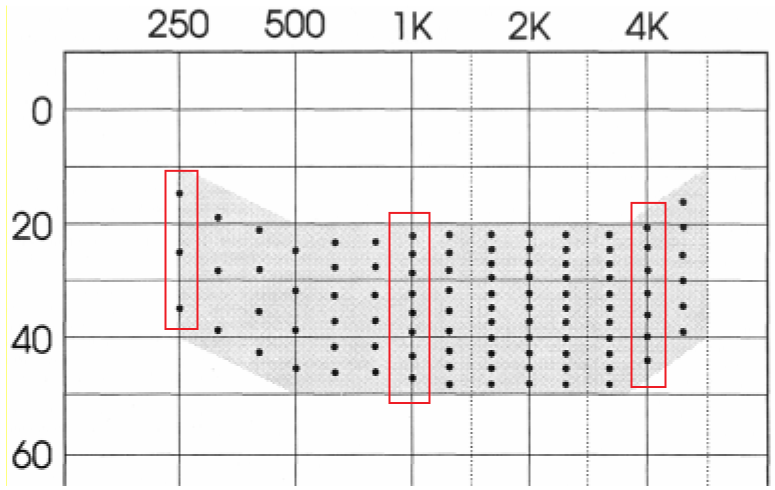


Figure 50. Articulation Index with Significant Findings. This figure highlights the frequencies that were significant in the univariate results.

Knowing that mild loss starts at 16 dB, it seems logical that this frequency be important to those children with mild hearing loss. Likewise, at 4000Hz, a typically significant frequency because of the concentration of speech frequencies, the impact of hearing loss begins at lower hearing loss levels (~15) coincides closely with hearing loss levels in the “mild” range. At 1000Hz, speech frequencies are highly concentrated compared to lower frequencies. For speech reception, 1000Hz is present in the second formant of all sounds where 2 or more formants are present (see Figure 51). The reduced intelligibility may be associated with the significant impact of group separation as those with failing scores had greater degrees of hearing loss, and likely less intelligibility of the second speech formant. In both the right and left ear, the most concentrated range of loss for who failed academically was between 21 and 29Db, but for successful children the loss was between 17-23dB across all frequencies.

Consonant	1st Formant	2nd Formant	3rd Formant	4th Formant
p			1500-2000	
t			2500-3000	
k	300-400		2000-2500	
d	300-400		2500-3000	
b	300-400		2000-2500	
g	**200-300**		1500-2500	
m	**250-350**	**1000-1500**	2500-3500	
n	**250-350**	**1000-1500**	2000-3000	
/ng/	**250-350**			4500-6000
f				**4000-5000**
s				5000-6000
sh			1500-2000	4500-5500
th				6000
h			1500-2000	
v	300-400			**3500-4500**
z	**200-300**			**4000-5000**
TH	**250-400**	**1000-1500**	2000-3000	
ch	**200-300**		1500-2000	4000-5000
dg	**200-300**		2000-3000	
l	**250-400**		2000-3000	
er	600-800	**1000-1500**	1800-2400	

Figure 51. Speech Formants. This figure describes the hearing frequencies that are necessary to understand speech sounds for common English phonemes.

Taking into consideration the frequencies identified as significant, the specific speech sounds impacted (Figure 51) include /m/, /n/, /ng/, /f/, /v/, /z/, /TH/, /ch/, /dg/, /l/,and /er/. With the exception of /z/ and /f/ the formants impacted by hearing loss at these frequencies do no prevent access to the entire speech sound, but only part of the speech sound. With partial access for formants of speech sound, it is probable that children with hearing loss in these ranges access the speech sound, but may not be able to fully distinguish the speech sound from other consonants with similar formant structures. For example, /m/ and /n/ have similar 3rd Formants, but diminished 1st and 2nd formants. A listener with diminished hearing loss in the 250 and 1000Hz ranges may hear these sounds indistinguishably.

What is surprising about these results is the lack of significant findings at 2000Hz (Figure 50)—the most concentrated region of the articulation index (Mueller & Killion, 1990). In addition to the concentration of speech demands, 2000Hz is known to be significantly impacted by otosclorosis, displayed as Carhart's notch (Venema, 2008). Due to the nature of this study, it is possible that the population impacted was not observed, as this type of hearing loss typically becomes most pronounced during adolescence, as only one subject (aged 15 years) presented such formations. Likewise, it is surprising that the left PTA is significant but right was not. Equal numbers of mild, left unilateral, right unilateral, and high frequency losses participated in this survey, meaning that the sidedness of unilateral loss did not sway the significant results.

These findings of significant results for left vs right side seem to contradict past studies that indicated right sided losses were more frequently associated with failure (Jensen, Johansen, & Borre, 1989; Lieu, 2004; Tharpe, 2007). Past research indicates that right hearing loss was significant, while left was not (Lieu, 2004) for unilateral hearing loss. In other past research, left hearing loss thresholds were more frequently diminished than right thresholds for MBHL (Segal, Shkolnik, Kochba, Segal, & Kraus, 2007). This study indicates that for children with MB/UHL, left ear PTA was significant, but right ear PTA was not significant for distinguishing separation between groups. Likewise, past research (Dancer, Burl, & Waters, 1995; Davis, Elfenbein, Schum, & Bentler, 1986; Powers, 1999) that indicates degree of hearing loss cannot predict outcomes seems partially contradicted as a difference was seen with the rates of failure of children with hearing loss between PTAs at 16-25dB compared to 25-40dB. In this study a separation could be observed. Children in this study with hearing loss thresholds between 16-25 continued to illustrate academic difficulties (Goldberg & Richburg, 2004), but not at the rates of those with 25-40dB hearing losses. This seems to mirror longitudinal studies that use degree of hearing loss as a significant predictor of outcomes (Ching et al., 2013).

Discriminant analysis was not significant, indicating that all of the variables taken together were not significant in defining separation between groups. Interestingly, when using only the significant variables (250Hz, 1000Hz, 4000Hz, and both articulation indexes), distinct group separation could be observed. Although these results were not reported in Chapter 4, they do add to the argument that the current study may not have had enough power based on the number of variables and sample size to actually show group separation on a discriminant function. These variables were heavily loaded upon in the discriminant analysis, but the analysis itself was non-significant. This is something that should be considered when making recommendations using this analysis.

The current audiological findings seem to indicate that while the definition of mild hearing loss (DB) continues to be appropriate for identification and intervention, academic limits for services may need to break the category further into two categories. As more students failed in the 23-40dB hearing range, the category of mild may need to be divided into “slight” and “mild,” with “mild” PTA flagged for academic monitoring or intervention. Additionally professionals working with children with MB/UHL should pay particular attention to the degree of hearing loss (>23dB) at 250, 1000, and 4000Hz as those frequencies aided in the prediction of group differences. This may indicate a need for changes in protocols established in 2011 by the American Audiological Association which recommend screening only at the 500, 1000, and 4000Hz ranges (Anderson, 2011).

Support Services: Early Detection and Interventions

The age of onset, presence of hearing loss at birth, and method of detection did not show significant results. However the cause of hearing loss and the treatment both during early childhood and during school experiences showed significant differences. Etiologically, most cases of hearing loss were due to unknown factors, as is true with most cases of hearing loss. More children who failed had a genetic predisposition to hearing loss. More successful children lost hearing due to infection, injury, or other late-onset factors. The later loss of hearing could be a factor that contributes to success as the pathways for audition functioned fully for a longer period of time than failing peers. For many of these children, especially those with chronic ear infection, the etiology of hearing loss also hints at fluctuating access to sound during the time where hearing was deteriorating.

The treatment of hearing loss brought some surprising and possibly confusing results. In most studies, early intervention is directly related to more positive outcomes for children with disabilities, including less frequent grade repetition and lower rates of high school dropout (Reynolds, Temple, Robertson, & Mann, 2001). For children with mild bilateral or unilateral hearing loss, the exact opposite was observed. Children who received early intervention had higher rates of academic failure. It is not to be assumed that that impact of early intervention was negative to child outcomes. What is more likely is that children who received early interventions had early, significant impact of hearing loss and were identified as 'most at need' of services. This qualification varies by state (NCHAM, 2003), and may not include mild hearing loss or unilateral hearing loss for services. In other words, those who qualify for early intervention may be qualifying not based on hearing loss, but based on other compounding factors.

Children who were successful in school were identified with hearing loss earlier than their failing peers. This is a typical pattern when compared to more severe hearing loss where early identification and intervention is attributed to successful outcomes (Yoshinaga-Itano, 2003). While differences were not significant, the pattern of distribution indicates that at all age levels (birth to two, 3-4, 5-7, 7+), children who failed were always more concentrated at older ages. Additionally, more parents were unaware of newborn hearing screening status from birth among children who failed.

Services

Several school and childhood services were examined including early intervention, past use of special education services, and current support services-including amplification usage. Significant differences were observed in past service provision (early intervention, past amplification usage, special education services, and past instructional modifications) and current service provision (amplification usage, special education services, and instructional modifications). These differences did not follow trends that were expected. Specifically, early intervention was expected to positively relate to academic outcomes (i.e., children with had early intervention would not have as many academic struggles), but was not. Amplification usage was expected to be more prevalent in successful students, but was not. Academic supports (special education services specific to hearing loss) were expected to be present only in the past for successful student and only in the present for failing students, but were not.

Early intervention (EI) has shown a reduction of 50% of failures; 55% for controls and 28% for early intervention participants in past studies (Ramey & Ramey, 1994; Ramey & Ramey, 1998a). Of students who participated in early intervention services in this study, more students who received EI failed academically (66%) than not (34%), however the sample of families who described early intervention services (n=19) is small, so results must be interpreted carefully. It is also important to note that of the children who failed academically and had early intervention services, one-quarter had additional disability noted, with known impact on cognitive ability in all cases. Only one child in the successful category had an additional disability, physical in nature. This presence of failing children early intervention must also be interpreted carefully. It could be easy for one to say that early intervention is related to later academic failure. This is not true. Early intervention has been shown to improve cognitive outcomes (Kuppler et al., 2013; Ramey & Ramey, 1998b), including improved language development outcomes for children with hearing loss (Moeller, 2000). There is evidence that the children who failed academically would have been even further behind had it not been for the intervention received.

With early intervention, early identification cannot be over looked. Part of early intervention services, although not directly a service defined in Part C of IDEA is the newborn hearing screening test and early detection methods. In this study, past research (Yoshinaga-Itano, 2003) indicating better outcomes for children identified with hearing loss within the first year of life were re-confirmed. Children who were earliest identified with hearing loss had the lowest rates of academic failure. Children who failed academically were twice as likely to be identified through school referral processes. This means that for these students, if hearing loss was present at birth, at least 5 years had passed before intervention began. These children who were identified through school screenings typically only account for those with hearing loss between 30-40dB between 500-4000Hz (Anderson, 2011), missing those children with mild hearing losses less than 30dB and with hearing losses at the significant 250Hz range. This reaffirms the research of Goldbert & Richburg (2004) that states not all children who need to be identified on hearing screenings are identified. With this knowledge, it is highly probable that students who qualified for this study have yet to be, and may not be identified. The late age of identification is not surprising as the average age of identification MB/UHL is 54.2 months (4.5 years of age) in recent research (Fitzpatrick, Durieux-Smith, & Whittingham, 2010).

Supports

Hearing aid usage for children who were successful, though less frequent than failing peers, remained consistent over time. Failing peers were more likely to have hearing aids, due to more significant hearing losses, but also less likely to wear hearing aids early-on. Children who failed academically were significantly more likely to begin using hearing aids later in life compared to successful peers who used amplification early.

This reinforces the need for early amplification and also corresponds with past research indicating the importance of early phonemic restoration (Baskent, Eiler, & Edwards, 2010; Ching et al., 2013). The same pattern for late-intervention with classroom amplification systems was observed. Children who struggled were later provided with amplification, while those who were successful had amplification early, but later decreased usage. Past research shows that a 10dB gain results in a 10% gain in performance on early auditory development tests in infants and toddlers (Ben-Itzhak, Greenstein, & Kishon-Rabin, 2014). A 10 % gain in auditory discrimination may indicate that the accessibility to a complete and consistent language model was present earlier for children who were successful.

Classroom amplifications, either personal or whole-class, decreased for both successful and failing students, with classroom amplification usage decreasing at a greater rate for students who failed academically. A decrease in usage for both groups is not surprising as many students who have more profound hearing losses also decrease classroom amplification usage because of social pressures (Marttila & Karikoski, 2006). Stapells et al. (2000) report that while for both mild and unilateral hearing loss, fitting for hearing aids reached nearly 80% by age 8.3, usage decreases by 50% in school-age children because of perceived stigma.

Failing students did receive more past and present intervention services (early intervention and special education) than their successful peers, which could be an indicator of needs-based assessments, as discussed earlier. However, against what would be expected, successful students maintained their level of support while failing students decreased their support level. This may indicate that the support that specialized services provided allowed for student success while the removal of such services was associated with increased failure. This thought is not uncommon in service provision debates and the addressing of all areas of development including hearing, social, emotional, academic, communication, and functional abilities must be considered when discussion service provision (IDEA, Part 300). Parents have, in the past, reported the need to fight for continued special services in order to provide access as students who are performing successfully in schools (Aron, 2005). The rationale behind the removal of services is that students who are successful do not need services, while in truth success may be because of those services. For children in this study, it is uncertain whether services were decreased before or academic failure, and further study into the phenomenon of performance with/without specific services.

Current service provision also showed that failing students more frequently received specialized education services. As the current service provision model is a failure model (students do not receive support until they fail), it is not surprising that failing students were referred for specialized support. What is most disturbing is the consistency of service provision over time. For successful students, those who received specialized services retained those services over time, with only a 0.4% decrease. Failing students however, saw a 3.4% decrease in service provision. This brings to challenge the concept of “Free and Appropriate Education” under the definition of IDEA. The Rowley case confirmed that appropriate education does not mean best education possible, as long as the child is making adequate progress (Aron, 2005; Thomas, 2004). Zirkel (2013) argues that the concept of free and appropriate education is still confused and needing a redefinition; barely making it is not good enough.

Other considerations that need to be discussed within specialized education services for children with MB/UHL is the role of self-advocacy, specifically with the management of hearing technology. Most (2004) showed that children with MB/UHL were frequently neglected in support service provision. This study reflected that showing an increase of hearing usage for failing students, but a decrease for service provision. With that in mind, it is likely that children who are now using hearing aids are no longer receiving support for the maximization of benefit from trained specialists. This may lead to the inconsistencies of amplification usage that has frequently been cited in the past (Reed, Antia, & Kreimeyer, 2008). Finally, these support systems have already been related to positive academic outcomes (Eriks-Brophy et al., 2007), so it seems anti-intuitive to remove the supports from those who have already failed.

Discriminant results for identification and intervention procedures were not significant. However, knowing the small sample size and the number of variables (16), it is possible that the sample size was not big enough to see significant results. Like with the audiological results, reducing to the variables that added most to the model (early intervention, age of detection, past hearing aids, current hearing aids), the model becomes significant in differentiating between groups.

These results seem to suggest that several considerations need to be made during the referral process for support services for children with MB/UHL. First, the age of identification must be considered. Early identification is critical for successful outcomes.

This study seems to suggest that early amplification is important, but not necessarily long-term use. Children who were successful often maintained usage, where as those who failed did not use amplification until later years. This again reinforces the importance of early phonemic restoration. It also appears that early intervention services are a strong predictor of continued need for support. Children who are assessed and receive EI are frequently the children with the greatest needs. While other children may benefit from EI, those who receive services under the current regulations for qualification should continue to be monitored.

Parent Perceptions/SIFTER Ratings

SIFTER scores indicate a perception of student performance, but are not necessarily a true indication of student performance as they are based on the knowledge of the survey taker on the general outcomes of typical students and a child with hearing loss. Typically the students measured on SIFTER scales are children with severe hearing losses, however the scale does not specific use for only children with severe-forms of hearing loss. In a recent study, Most (2004) indicated a linear relationships between SIFTER scores and degree of hearing loss. However, in the case of successful and failing students, this is only true of the failing students. Students who are successful actually increased scores with average degree of hearing loss.

Examining the scale cut off levels for (Figure 24: SIFTER score distribution) no-risk, moderate risk, and severe risk, it is noted that children with greater academic risk are rated lower on the academic scale. This is exactly the finding the communication and academic achievement results. These ratings indicated that parents of successful children rated their children higher in academic skills and communication skills than their failing peer. These parents also rated their children as highly enough to be classified as “low risk,” compared to students who failed who were classified as “moderate risk” in both areas. These two areas are the only two areas to follow expected patterns of ratings. . These findings were consistent with past research (Dancer et al., 1995; T. Most, 2004; Tova Most, 2006) indicating lower ratings in academic skills and communication skills for children with hearing loss who are at risk for school failure.

The areas of behavior, attention, and participation all followed unexpected patterns. While a significant difference was noted in behavior, the pattern was not in the positive direction for successful students as expected (Malinauskiene, Vosylis, & Zukauskienelis, 2011). Parents/guardians of children who were successful rated their children in the “high risk” range for problem behaviors while students who failed were rated as “marginal risk.” The behavior category questions parents about students’ age appropriate behaviors, frustration levels, and acceptance by others. The scores for both groups of children (successful and failing) indicate that children with mild bilateral or unilateral hearing loss are perceived as being less mature, more frustrated, and less accepted in the school environment compared to their general peers. What is not certain is if the successful student’s lower ratings than their failing peers are due to parent awareness of difficulties or if an actual difference is occurring. Because worse scores are typically associated with more risk, these results may indicate that parents/guardians of successful children are more aware of the difficulties their children are having in school and therefore, may be intervening in a more intense manner.

A similar pattern of lower scores for successful students occurs in both attention and participation, although the differences are not significant. Questions about attention focus on length of attention span, distractibility, and hesitation to respond to oral questions. In this category, successful students were rated as “marginal” while successful students were rated as “at-risk.” Class participation asked about volunteering in class, completion of assignments, and independence of work completion. In this case, failing students were rated as “passing” and successful students were rated as “marginal risk.” In both these cases, failing students were rated by parents/guardians as doing better in school than successful peers. Like the behavior ratings, it is questionable whether these ratings mean that failing students are participating more and have stronger attention spans, or if parents/guardians are not aware that their child has weaker attention spans or does not participate.

Discriminant results for SIFTER scores, including self-advocacy are not significant for separating groups. While academics, behavior, and communication ratings are significant at the univariate level, all variables combined do not provide enough separation. In future studies, it would be important to note that these differences were ratings of parents and not of teachers, as the tool was originally designed. It may be possible that the scores used for definition of risk may differ from those used in past research.

School Characteristics

Both the size of elementary and middle schools were significant, yet other school factors such as the number of schools and the size of preschools and high schools, were not significant. Successful students most frequently attended small to medium sized schools, with more attending medium sized-schools.   Failing students attended larger schools most frequently. The trend of general education settings indicate that children in smaller schools achieve equally or above children in large school settings (Cotton, 1996; Leithwood & Jantzi, 2009; Magdol, 1998). Like the number of students for size classification for this study, the size of school changes from elementary to middle and high school settings. What differs from the outcomes expected is that students who were most successful actually attended small or medium schools, indicating that slightly larger schools than expected were related positively to outcomes.

This reflects a trend that case-load size and school size, impact the quality of special education services. One factor specifically noted is that specialized education services are received from certified practitioners, rather than para-professionals (Suter & Giangreco, 2008) in small, but not extremely small settings. Additionally, middle sized schools have been rated as ideal for learning (Lee & Smith, 1997). It is possible that the concentration of successful students with mild bilateral or unilateral hearing loss in medium-sized schools may indicate that there is either a greater set of resources (support services, personnel, staff, amplification, etc.) in such settings, a greater awareness of how to support the unique needs of children with hearing loss, or a tendency to relocate children to settings where the services which best-fit needs are located.

Past research indicates that school mobility or change is frequently associated with negative impact on student outcomes (Alexander, Entwisle, & Dauber, 1996; Heinlein & Shinn, 2000; Lucio et al., 2012; Rumberger & Larson, 1998). However, change itself was not noted as being the leading reason for impact in these studies, but part of the entire picture of why children change schools. For example, the leading cause of school mobility is familial structure change (Burkam, Lee, & Dwyer, 2009) which often comes with changes in SES and supports available, not to mention emotional impact. Noting these factors and controlling for them, a single change between Kindergarten and First Grade shows little impact on students success; the same can be said for grade 1-3 change of school during summer break. However, two or more changes during these years has a small to medium effect on cognitive outcomes (Burkam et al., 2009). These outcomes are particularly compounded when lower SES status and disability are present. Mixed results are seen in later school experiences, with school change showing both positive outcomes related to transfer for academic program, but negative impact short-term for grades 8-10 and negative outcomes long-term for 11th- and 12th-grade transfers.

The current study indicated that the number of schools was not significant, yet the low number of participants indicates that a larger *N* would be desirable before having a definitive significant/non-significant decision. Examining the other characteristics of children who failed and frequently transferred schools) differences are observable. For example factors such as change in family composition may variable to school mobility and differences in performance, either positive or negative depending on the change of circumstance. In short, due to the relatively small N of this study, it is impossible to make definite conclusions. However, it is important to note that discriminant analysis was also significant, indicating a separation between groups based on size of schools and number of schools. Heavy load was placed on the size of preschools, middle, and high school as well as the number of elementary, middle, and high schools. In other words, size and number of school is almost always important when considering all factors at once.

Child Demographics

Of child characteristics two areas were significant; additional disability and ethnicity. The few factors that are significant are surprising, as in the general population all four of these factors are known to put a child at greater risk for academic failure (Frey, 2005; Gutman, Sameroff, & Cole, 2003; S. Jimerson, Egeland, Sroufe, & Carlson, 2000; S. R. Jimerson, Anderson, & Whipple, 2002). When examining additional disabilities, the most commonly noted disabilities included speech language impairment, auditory processing disorder, specific learning disability, attention deficit disorder, and autism. Of these disabilities, all could be the misperception of the impact of hearing loss if proper treatment of auditory deprivation is not considered (Creedon, 2006).

With the additional consideration of home language significance (reported under family characteristics), children who have hearing loss and a home language other than English are even more likely to be diagnosed with a secondary disability, which may be just the impact of home language to school language gaps compounded by hearing loss (Antia, Jones, Reed, & Kreimeyer, 2009; Culbertson & Gilbert, 1986; T. Most, 2004; Vernon, 2005). Likewise, children who are of Hispanic ethnicity have higher concentrations of secondary languages and home, as well as higher rates of disability diagnosis with questionable impact of language and culture. Multiple studies have indicated that within the group of children with hearing loss from multilingual homes, particularly those of Hispanic ethnicities, frequently struggle with academic progress (Antia et al., 2009; Cohen, Fischgrund, & Redding, 1990; Reed et al., 2008). This finding was affirmed in this study as children with Hispanic ethnicity identified were more likely to fail, as were children where secondary languages were present, particularly Spanish speaking families. This finding is not surprising as similar results are found in hearing populations, as well as in other disability categories progress (Gutman et al., 2003; S. Jimerson et al., 2000; Lucio, Hunt, & Bornovalova, 2012; Powers, 1999).

Deaf children with additional disabilities are known to be at greater risk for academic difficulties, some of which may be attributed to the lack of understanding as to how to address educational needs that are compounded by additional disabilities (Ching et al., 2013; Guardino, 2008). In the case of children with mild bilateral or unilateral hearing loss, children may be identified by another primary disability, with hearing loss taking a back seat to the more prominent disability. For these children, the impact of hearing loss may be overlooked, especially in the case of children identified with Down’s Syndrome, Autism, Cerebral Paley, and other high-intensity disabilities. Other more high incidence disabilities, such as ADHD, Speech Language Impairments, and Specific Learning Disabilities are also frequently identified among children with hearing loss, and may be a display of symptoms of hearing loss that are shared with these disabilities (i.e. inattention, language development delay, hyperactivity, difficulty reading). This finding reaffirms past research indicating that the presence of additional disabilities to hearing loss increase rates of academic failure (S. Jimerson et al., 2000; Reed et al., 2008; Schonweiler, Ptok, & Radu, 1998).

Though classified under identification factors in this study, children with etiological factors such as those with genetic origin, showed a significantly greater risk for failure. In this study the presence of genetic deafness is partially related to syndrome factors (e.g., Down Syndrome). This means that both presence of second disability and etiology are related. However, a greater number of parents than expected indicated a genetic presence that may likely be induced hearing loss. One parent noted, “his grandmother wore hearing aids.” This is not necessarily genetic hearing loss. Students who failed showed significantly more children with injury or illness at a later age, including chronic ear infection, tumors, high fever, noise-damage, and perforation. These later deafened children indicate that the change of hearing status may be important to increase risk of failure and that the adjustment to hearing loss period may not be addressed in a manner that reduces impact of losing hearing.

Several factors did not show trends as would be expected in this study, including; gender and race. Byrd and Weitzmanm (1994) indicated that race (minority) and gender (male) increased likelihood of grade retention, as do multiple studies to follow (Ching et al., 2013; Frey, 2005; Huffman, Mehlinger, & Kerivan, 2000; Lucio et al., 2012; Meisels & Liaw, 1993). In this study, neither race nor genders were significant differences between successful and failing students. In both cases, it is suspected that the sampling errors described under the limitations section of Chapter V, may influence these outcomes. In the case of race, few children were identified from minority groups. By gender, more participants were female than male.

Discriminant results were significant and loaded heavily on additional disability. In short, factors such as race, ethnicity, and gender were not necessary for distinguishing groups. Ethnicity, though significant in univariate methods, did not load heavily in the multivariate model. This does not downplay the impact of language associated with ethnicity differences in most cases (see family characteristics for details.)

Family Demographics

Familial characteristics that were significant included mother's educational level, languages of the home, and income of the family. Non-significant variables included father's educational level, family size, community size, and family composition. All variables were expected to have significant differences, with the exception of Father's educational level. This illustrates differences from expected outcomes.

Mother's educational level in this study was significant as expected, as has been shown in past educational studies (Ching et al., 2013; Gennetian La, 2008; Haveman, 1995; Rosenzweig, 1994). The impact of mother's educational level has also been positively correlated with student outcomes in children with hearing loss (Sarant Jz, 2009). Like past studies, mother's educational level had a stronger impact on outcomes than did father's educational level (Lacour & Tissington, 2011). Mother's with higher levels of academic attainment have had positive variables described including more accessibility to resources, beginning parenting at an older age, increased home-literacy activities, and a greater likelihood of planned childbearing (Lappegård & Rønsen, 2005).

In this study, greater educational levels of the mother showed a positive impact on educational success among children with mild bilateral and unilateral hearing loss. Only 6% of mothers of successful children had less than a 2-year degree, where 18% of mothers of failing students had less than a 2-year degree, including 4% who had no high school degree. Mother's educational level has been shown in past studies (Gutman et al., 2003; NCES, 2010) to be highly correlated with children's outcomes. Like the national trend, parents of color and parents of Hispanic ethnicity were less likely to have higher levels of educational attainment. This compounds risk factors for many children by including the impact of language and ethnicity discussed earlier. Father's educational level was not expected to be significant (Myers et al., 2010), nor was it significant in this study.

Home language was also significantly different between groups; students who were successful tended to have English as a primary language while children who failed academically often had English as a secondary language at home. As mentioned, this language difference also paired closely with ethnicity—Hispanic children with primary languages of Spanish origin. These results were expected based on past research (Sullivan, 2011). What was surprising was the percentage of children who had exposure to American Sign Language (ASL) who failed. Sixty percent of ASL users failed academically. This is not saying that ASL was the problem for success, but that the implementation of ASL as a communication mode may have been an intervention towards the improvement already noticed lack of language development. It may also be an indicator of a misconception among parents that children with hearing loss must learn

ASL. In either case, it is interesting that a manual mode of communication was chosen for a type of hearing loss that is often over looked because of the dominance of accessibility of language through auditory medium.

Poverty also is known to increase the risk of academic failure in general populations (Frey, 2005; Gutman et al., 2003; Lucio et al., 2012; McLoyd, 1998; Powers, 1999), and was observed as significant in this study. The variable of poverty often influences, or is influenced by other variables. For example, poverty often influences number of schools attended, size of school, community type, education levels and interventions. Poverty is influenced by race, ethnicity, language, family status, and educational levels.

Huffman, Mehlinger, and Kerivan (2000) indicated that family composition can influence student outcomes. This study did not reaffirm that finding. Neither family structure (Eriks-Brophy et al., 2007; Gutman et al., 2003; Reed et al., 2008) nor number of persons (Gutman et al., 2003) in the household were found to be significant in this study. These reasons again, may be a direct reflection of the lack of participation of such families. In this study, a majority of families were from a two-parent family with a small number of children. This is not the distribution that was expected to be observed. Likewise, community size, which often directly relates to family composition, family size, and income level, were not significant. Past research has indicated that the location of a child's home frequently influences the outcome of educational endeavors (Magdol, 1998). Again, representation was limited from all community types.

Discriminant results were significant and loaded heavily on mother's educational level and household setting. In this case, two-parent family and higher educational level of the mother were linked to successful students and lower educational levels and single-parent household or multigenerational households were linked to failing students. It is interesting to note that family composition, specifically number of parents was not significant at the univariate level, but did influence the multivariate model.

In the case of familial influences practitioners should be aware of the positive influence of mother educational level, the presence of a two-parent family, SES status, and family language. These all are identified as having influence over multiple factors, including one another. This is not saying that children with these positive influences will not fail, but that they are less likely to fail with the presence of these factors.

Discussion of the Conclusions in Relation to the Literature and the Field

Like children of mixed identity, children with mild or unilateral hearing loss are caught between two groups—they are not fully included in the dominant group (hearing) and not fully deaf. If they fully functioned as either, we would expect to see differences in the outcomes. For example, if children with MB/UHL functioned as hearing, we would expect only the areas known to be of a general population to separate groups (i.e., race, gender, socioeconomic, parent income). Likewise, if these children were fully members of deafness, we would expect differences in groups to relate to the factors impacting children with hearing loss (i.e., SIFTER, all areas of audiogram, identification). Instead, children with mild bilateral or unilateral hearing loss saw mixed results; several areas were impacted as expected, several areas were not impacted as expected.

So looking at where these children fit, the answer is- there is no answer as of now. These are children with hearing loss who function different than children with severe or profound losses, but they at times may function like hearing children. There are known areas of need, and these areas should be addressed as with any child with hearing loss. With the proper identification of service need, it may be possible to reduce the impact of hearing loss on academic outcomes and reduce the isolation from identification as hearing by providing strategies and networking opportunities.

If, as professionals, we continue to fail to recognize the impact of hearing loss even at the mild level, we alienate a group of children from the full potential for learning. It is true that educational rights do not promise the best educational possible, only an adequate education, however an adequate education is not enough for at least 35% of children with MB/UHL. The question that we are left with is whether or not we are willing to provide children with the early support services they need, or if good enough is equitable enough and worth the risk of failure and drop-out. By continuing to focus only on the needs of the two ends of the hearing spectrum, we are saying to the middle that their needs don't matter. The truth is, the impact of hearing loss is not a black and white, binary spectrum. Profoundly deaf individuals have been known to have no educational difficulties, just as individuals with mild hearing loss have had a severe impact on academic progress. Hearing loss is not an exact science with regards to educational needs—yet we continue to wrongfully treat it as such, impacting most those children who look like they need the help the least.

Recommendations for Further Study

Methodological Recommendations (Limitations)

A major methodological weakness of this study centralizes on recruitment methods, resulting in a small number of fully complete survey respondents. Due to this weakness in recruitment, a shift in analysis was required. In the proposal phase, this study was designed as a discriminant analysis with univariate follow-up. Due to the difficulty of recruitment, methodology evolved to rely upon univariate comparisons with discriminant follow-up, weakening the ability to generalize the contribution of factors overall to the success/failure of students with MB/UHL. Ideally, this study would benefit from working with schools or medical facilities to directly access child records, including audiogram, educational progress, and teachers. Access of such information could result in identifying those children whose families would have qualified for participation, but whom may not have recognized their qualifications.

Due to the constraints of not having established collaborative relationships with medical and academic centers, the recruitment methods depended heavily on snowball effect, targeted social-media presence, and flyer distribution on public forums and bulletin boards. These methods likely attributed to the non-response phenomenon revealed including failure to deliver to a representative sample and inability to participate (Groves, et al 2009). Specifically, very respondents came from lower SES households, single-parent households, and low educational levels. Additionally, most of the families had a strong command of English language, although some families had bilingual or trilingual households.

Non-response rates could also be attributed to the difficulty of actually contacting the appropriate families. Support groups exist for parents of children with severe forms of hearing loss (e.g., CI Parents, Parents of CI kids, ASL Parents, Parents of Deaf School Children), but few groups exist that specifically support the issues parents of children with mild hearing or unilateral hearing loss face. Groups that were located centered in Australia and Israel. Even adult groups for hearing loss have very few representatives with mild or unilateral hearing loss, as discussions often center on treatment of deafness that prevents access to most language, instead of deafness that prevents access to some language.

Another constraint for response rates was that of the audiometric measures. Because participants needed to have a specifically defined hearing loss to be considered (PTA 16-40dB or Unilateral), audiogram input was required. While participants reported that they were able to easily enter their audiogram information into the form used, many reported that they did not have an audiogram available or that it had been so long since their last visit, that their audiogram was no longer appropriate for measuring hearing loss.

The survey tool itself benefited from an initial two-phase pilot study. Questions were rephrased and reordered to best meet the needs of participants taking the survey. The reordering of questions also increased the completion rate from pilot to full-study. However, do to the required removal of forced responses to maintain ethical standards, an increase was observed in non-response to questions. So while parents finished the survey, they finished less of the survey.

One question that was raised by the survey tool is the use of the SIFTER by parents rather than teachers. The SIFTER is typically completed by teachers or school staff members. Because of the question of weaker scores for successful students, it would be interesting to follow up with teachers of these students to see if parent perception matches that of the teachers. No research was found to illustrate parent's perception of students' risk factors and performance, especially in regards to accuracy of parent understanding of student participation in academic environments. It is highly probable that parent perceptions and teacher perceptions of student behavior, progress, and achievement in the classroom would differ.

Finally, as mentioned earlier, the analysis methods used for the original study design had to be modified due to the limited number of complete surveys. While discriminant analysis was conducted for each sub-set, an overall model of all factors could not be conducted. Ultimately, to derive a more statistically accurate model for prediction of success/failure in children with mild bilateral or unilateral hearing loss, factors from this study should be reconsidered with a larger sample size. Even in the case of those variables that were not significant (e.g. race, SES), consideration of the impact should be considered as the nonresponse impact may be hiding underlying factors that were not observed in this particular study. Currently, this study may still provide professionals working with children who have MB/UHL a guide for progress monitoring, especially for audiological characteristics. However, like all models, this is a prediction model and can never fully account for the complexity of human nature.

Data Recommendations (Future Studies)

This study begins to touch on the many gaps in knowledge associated with both mild hearing loss and performance in school and unilateral hearing loss outcomes for academic performance. Past research (Laury, Casey, McKay, & Germiller, 2009) states that both mild and unilateral hearing losses are unique and should be treated as such. For the purpose of this study, the groups were combined to create a larger sample population. Future research would benefit from larger sample size study with these group separated. Even as the study is conducted currently, the larger sample would be beneficial for generalizability.

A study of issuing the SIFTER to parents and teachers in order to compare perception of student ability and risk would be another study that could be further explored. This study illustrated that parents of failing students actually rated their children as higher functioning than parents of students who were successful. This gap in perception and performance may be representative of a misconception of student performance in the classroom by parents/families. Comparing parent and teacher perception of child access in the classroom can be informative not only to children with mild or unilateral hearing loss, but for the entire spectrum of hearing loss.

This study identified a need to understand the rationale off the continuation or discontinuation of specialized education services for children with mild or unilateral hearing loss. In this study, children who failed were more likely to have had specializes services in the past, but to no longer have services provided. It would be beneficial to understand when and why services were discontinued to understand the circumstances related to service provision changes.

This study can also lead to the next step of identification—provision needs. This study identifies characteristics that help group students based on areas of risk identified in the past. There has yet to be any study as to the actual services provided and goals of service provisions for children with mild and/or unilateral hearing loss. For children with mild and unilateral hearing loss, the goals that are needed for support may be similar to those of children with profound loss, however it is currently unknown if the services are strictly hearing management or if similar goals to children with more pronounced hearing loss, such as language development, speech, listening, and self-advocacy, are necessary for student success. It could be hypothesized that since these students show similar risk areas (language development, social interactions, discrimination, speech, etc.) that the services should have similar goals, but with different intensity levels. However, no study could be found as to this.

Other Recommendations (Delimitations and Relevant Issues)

The last consideration needed as a conclusion of this study is communication. Four groups of adults interact for the progress of children with mild or unilateral hearing loss; parents/families, teachers, audiologists, and pediatricians. In none of the research conducted is there collaboration between these four groups; however in multiple studies, including this one, found there to be a disconnect in opinions on treatment. If the concern is actually the provision of appropriate interventions to prevent failure, the message given to parents from ‘authority figures’ (i.e., teachers and medical professionals) should not be conflicting. In a time where digital communication bridges worlds, there is no excuse for a lack of clear standards for diagnosis, expectations for outcomes, and interventions between these communities of professionals. It is time to join together in order to reduce the frustration levels and confused messages parents receive about the impact of hearing loss for their child.

Framework

Relating back to the idea introduced in Chapter II that children with mild or unilateral hearing loss are marginalized as a mixed percentage identity (Katz, 1996) of hearing and Deaf perspectives, this study helps us to gain insight into exactly how these students function as neither hearing, nor as Deaf. If functioning fully as hearing children, one would expect the results of this study to parallel hearing children only—in other words, audiological, identification, and treatment factors would not indicate an impact on children’s outcomes. If functioning as only Deaf, one would expect the impact of all hearing, intervention, and perception factors to be significant. This is not the case in either sense. Children with mild or unilateral hearing loss have impact of hearing factors, but not in all cases. Children with MB/UHL display a significant impact of some general population risk factors, but not all that would be expected if it was solely attributed to being part of the general population.

To the educational atmosphere, this implies that educational professional must continue to examine and recognize the impact of hearing loss even at the degree of mild on academic outcomes. The status of disability, and thus the status of hearing loss in an educational environment is, at the moment, binary—a child is or isn't disabled and this disability is not necessarily consistent across medicine and education. The identity applied, based on the knowledge of institutions and the value of the institutions objectifies the child to a set of parameters for "categorization"- in this case profoundness of hearing loss is typically the qualifier. The reductionism of a child to hearing characteristics only (Katz, 1996) denies the entirety of his/her experience, including the interaction of biology, beliefs and opinions, relationships, and status (Katz, 1996).

Educational policy (the Communication Plan) mandates that for a child with hearing loss, four things should be considered: language and communication needs, academic needs, direct communication, and full-range of needs. Beyond the presence of a hearing loss with adverse effect, the law does not dictate a minimal hearing level to qualify, however individual states have the ability to define a specific range as qualifying. This means that despite qualification of having a hearing loss, children in the mild range or unilateral with normal hearing in one ear may be reduced to a hearing test and excluded from potential service for the compounding effects of other factors with the hearing loss. In other words, without recognizing the impact of hearing loss is more than an audiogram, children with mild or unilateral hearing loss are "not deaf enough," yet not fully hearing. Mild hearing loss and unilateral hearing loss is more than an audiogram, just as the impact of profound hearing loss is more than an audiogram.

This study continues to resound the concept of reducing reductionism. If children with mild or unilateral hearing loss were single-faceted, the audiogram would be all we need to categorize children into "success" and "failure" groups—and the field of deaf education would be much easier. The reality is—the impact of hearing loss is not that simple. Children who have MB/UHL should be considered on an individual basis, including the compounding effect of additional risk factors. As the practice of not serving those who are 'not deaf enough' and 'not hearing,' we continue to risk failing students who would not have failed without a hand to reach out. The man hours it would take to screen for risk are minimal compared to the cost of failing students and drop-outs—a risk I am not willing to stop advocating against.

Conclusion

In short, this study identified areas that can be used as a screening tool for children with mild or unilateral hearing losses who are at risk for academic failure. It highlights the need for inclusion of these children in not only screenings, but academic referral for early support in language and listening. With the presence of failure having a high concentration at lower levels of hearing loss than current screening procedures use for screening, it calls for another examination of the hard cut-off lines used for referral, as they may not be appropriate. Finally, it emphasizes that child with mild bilateral or unilateral hearing loss do in fact have many of the same needs as children with greater degrees of hearing loss. It is time that educators are prepared to identify and serve these needs in order to reduce the failure rates of this subset of deaf and hard of hearing children.

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APPENDIX A

RESEARCH DESIGN LOGIC MODEL

Research Question	Areas to Examine	Survey Questions	**Question**	Analysis Method	Changes from Pilot
Are there similar demographic factors in children with MB/UHL who are 'at risk'?	Overall Trend in characteristics in Group Belonging?	All		Discriminant Analysis	Dropped due to number of participants
Are there similar audiological factors in children with MB/UHL who are 'at risk'?	Articulation Index	Q13-audiogram	Please enter your child's most recent audiogram into the responses below. Some of the data from your audiogram will not be uses, as some audiologists provide more data for their own accuracy. Some of the data on the audiogram may not be provided. If a requested item was not recorded, chose the response UNABLE TO PROVIDE located at the bottom of the audiogram. Date of Audiogram MM/DD/YYYY or N/A	Dot Method (Mueller & Killion, 1990)	Changed input method, same data collected
	Sided Hearing Loss (UHL only)	Q13-audiogram			
	PTA	Q13-audiogram		(500+1000+2000 +4000)/4	
	Amplification Usage	Q14	What services or supports has the child/student with hearing loss received in the past? (Check all that have apply).		
		Q62	Did the child use his/her amplification (hearing aids, FM system) all or most of the time?		

Research Question	Areas to Examine	Survey Questions	**Question**	Analysis Method	Changes from Pilot
		Q41	What services or supports does the child/student CURRENTLY receive? (Check all that apply).		
Are there similar school structure factors in children with MB/UHL who are 'at risk'?	School Size	Q6	Which county are you currently residing?	Discriminant Analysis	Deleted.
		Q44-extracted	Where does your child/student currently attend school?(		
	Typical Classroom Size	Q44-extracted	Where does your child/student currently attend school?(	Discriminant Analysis	Changed. Originally asked for school, now asks for size of school (based on population size)
	School Success Measure	Q44-extracted	Where does your child/student currently attend school?(	Discriminant Analysis	Deleted
	Classroom Services	Q15	How is the child served in school?	Discriminant Analysis	
	Number of Schools Attended	Q45	How many schools has your child/student attended?	Discriminant Analysis	

Research Question	Areas to Examine	Survey Questions	**Question**	Analysis Method	Changes from Pilot
Are there similar traits in children with MB/UHL who are 'at risk'? (Measured through the SIFTER tool)	Academics	R1+2+3 OR	• How does your child's reading level compare to the difficulty of work expected in classes? • How does your child's ability to summarize and draw conclusions about information presented in class compare to his/her class peers? • How does your child's demonstration of academic skill growth compare to class peers/expectations?		Spelling errors fixed
		S1+2+3	• What is your estimate of your child's class standing in comparison of that of his/her classmates? • How does your child's achievement compare to your estimation of his/her potential? • What is your child's reading level, reading ability group, or reading readiness group in the classroom?		
	Attention	R5+6+7 OR	• When called upon and asked a question, how often does your child appear to have been attending/ listening? (How often does he/she understand the basis of question?) • How successful is your child at avoiding distraction by noises, visual distractions, personal items, or activities unrelated to instruction or conversation? • How does your child's attention to detail compare to class/peer expectations?		

Research Question	Areas to Examine	Survey Questions	**Question**	Analysis Method	Changes from Pilot
		S5+6+7	• How destructible is your child in comparison to children of the same age? • What is your child's attention span in comparison to that of children the same age? • How often does your child hesitate or become confused when responding to SPOKEN DIRECTIONS?		
	Communication	R9+10+11 OR	• How well does your child communicate his/her needs to the teacher/parent in comparison to peers/expectations? • How does your child's word usage skills compare to children of the same age? • What is your estimate of your child's ability to understand teacher instruction without help in comparison to peers?		
		S9+10+11	• How does your child's comprehension of instruction n compare to the average understanding ability of his/her classmates? • How does your child's vocabulary and word usage skills compare with those of other students in his/her age group? • How proficient is your child at telling a story or relating happenings from home/school to other situations compared to peers?		

Research Question	Areas to Examine	Survey Questions	**Question**	Analysis Method	Changes from Pilot
	Participation	R14+15+16 OR	• In comparison to children of the same age, what is your child's present level of meaningful contribution to classroom discussion or group discussions? • To what level does your child demonstrate a recognition that participation is an integral part of the learning process? • During cooperative group activities, how often does your child interact with others to achieve the goals of group work?		
		S14+15+16	• How often does your child volunteer information to discussions or answer questions in a group? • With what frequency does your child complete his/her homework assignments within time allocated? • After instruction, does your child have difficulty starting to work (i.e. looking at others or asking for help)?		
	Behavior	R17+18+19 OR	• How often does the student demonstrate respectful behavior towards others in the class (peers and teachers)? • How often does the student follow classroom rules compared to peers? • To what level does the student appear to have relationships with his/her peers?		

Research Question	Areas to Examine	Survey Questions	**Question**	Analysis Method	Changes from Pilot
		S17+18+19	• Does your child demonstrate any behaviors that seem unusual or inappropriate compared to other children the same age? • Does your child become frustrated easily, sometimes to the point of losing emotional control? • In general, how would you rank your child's relationship with peers (ability to get along with others)?		
		Behaviors	R17+18+19 OR S17+18+19	(see above)	
	Overall Sifter	Peer Relationships	R19 OR S 19 To what level does the student appear to have relationships with his/her peers? In general, how would you rank your child's relationship with peers (ability to get along with others)?		
	Self Advocacy	Q67 OR	To what extent does your child understand the need to advocate for his/her needs in the classroom?		
		Q68	How often will your child advocate for his/her needs in the classroom?		
Are identified similarities among 'at risk'	Language (s)	Q1	What is the primary language spoken in your home (i.e., the one you speak most of the time)?		Added Pidgin sign

Research Question	Areas to Examine	Survey Questions	**Question**	Analysis Method	Changes from Pilot
populations different than hearing peers from past research?		Q60	Are any other language (s) spoken in your home?		Added Pidgin sign
	Income	Q9	Please indicate the current household income in U.S. dollars in which the child/student with hearing loss dwells.		
	Additional Disabilities	Q69	Does your child have additional disabilities to hearing loss?		
	Race	Q48	What is the child/student's race?		
	Ethnicity	Q49	What ethnicity is the child/student?		
	Parent Education Level	Q3	Please indicate the highest level of education completed by the MOTHER of the child/student with hearing loss.		Added license training (non-program)
		Q38	Please indicate the highest level of education completed by the FATHER of the child/student with hearing loss.		Added license training (non-program)
	Academic Progress	Q42	Has your child/student repeated a grade?		
	Academic Progress Gender	Q43	Indicate any grades that your child/ student has repeated.		
		Q27	What grade range is your child currently in/ recently finished?		
		Q65	What grade is your child currently in/ recently finished?		
		Q50	What is the gender of the child with hearing loss?		

Research Question	Areas to Examine	Survey Questions	**Question**	Analysis Method	Changes from Pilot
	Family Size	Q8	How many adults AND children live in your household?		
	Community Size	Q7	Which of the following best describes the area you live in?		
	Family Status	Q5	What is your current household status?		Added additional categories
	Caregiver Occupation	Q16	Which of the following categories best describes the industry the PRIMARY CARE GIVER works in?		Deleted
Are age of onset, identification, or etiology predictors of which children with MB/UHL are be 'at risk'?	Age of Onset Identification	Q61	Was the hearing loss present at birth?		Expanded age groups to be more specifc
		Q12	How old was the child/student when his/her hearing loss was detected?		
	Identification Etiology	Q61	Was the hearing loss present at birth?		
		Q39	How was hearing loss first detected?		
		Q59	What is the cause (etiology) of hearing loss?		
	Services Provided	Q14	What services or supports has the child/student with hearing loss received in the past? (Check all that have apply).		
	Services Provided Early Intervention Services	Q41	What services or supports does the child/student CURRENTLY receive? (Check all that apply).		
		Q15	How is the child served in school?		
		Q14	What services or supports has the child/student with hearing loss received in the past? (Check all that have apply).		

Research Question	Areas to Examine	Survey Questions	**Question**	Analysis Method	Changes from Pilot
	Early Intervention Services	Q41	What services or supports does the child/student CURRENTLY receive? (Check all that apply).		

APPENDIX B

RESEARCH QUESTIONS

Dissertation 2014

Q75 Project Title: Factors characterizing the academic experience of children with mild bilateral or unilateral hearing loss Project Director: Stephanie Gardiner-Walsh; Dr. Mary V. Compton What is the study about? This is a research project focused on gaining an understanding of the factors that may contribute to the success or failure of children with mild bilateral or unilateral hearing loss. The goal of this study is to identify possible trends in demographic data, audiological data, and parent/caregiver ratings of child/student performance in multiple domains (academic, behavioral, social, communication, and language). Your participation is voluntary. Why are you asking me? The reason for selecting the participant; is that you have been identified the parent or caregiver of a child who has mild bilateral (both ears) or unilateral (one ear) hearing loss. What will you ask me to do if I agree to be in the study? For this study, you will be asked to complete a 10-15 minute online survey about your child who has mild bilateral (both ears) or unilateral (one ear) hearing loss. This study is a survey and will only require an analysis of your responses to questions. There are no anticipated dangers for participation in this study. What are the dangers to me? The Institutional Review Board at the University of North Carolina at Greensboro has determined that participation in this study poses minimal risk to participants. If you have any concerns about your rights, how you are being treated or if you have questions, want more information or have suggestions, please contact Stephanie Gardiner-Walsh, principal investigator at 336-462-9525 or sjgardin@uncg.edu and/or Mary V. Compton at 336.334.5843 or mvcompt@uncg.edu . If you have any concerns about your rights, how you are being treated, concerns or complaints about this project or the benefits or risks associated with being in the study, please contact the Office of Research Integrity at UNCG toll-free at (855)251-2351. Are there any benefits to me for taking part in this research study? There are no direct benefits to participants in this study. Are there any benefits to society as a result of me taking part in this research? This study aims at broadening the understanding of the factors which may contribute to academic success or failure for children with ‘mild’ forms of hearing loss. This study may provide information to current teachers on factors which should alert them for the need to follow students more closely to ensure timely interventions if academic difficulties should occur due to the nature of the hearing loss. Will I get paid for being in the study? Will it cost me anything? There are no costs to you or payments made for participating in this study. How will you keep my information confidential? All responses made survey will be maintained for the duration of the study via encrypted files through Qualtrics Survey Software. Data will be destroyed upon completion of study related activities.. Paper copy of any downloaded responses will remain locked in a filing cabinet in the GA lab of the School of Education at UNCG. Electronic copies will be password protected and remained on a closed network. All information obtained in this study is strictly confidential unless disclosure is required by law. IP addresses collected for the purpose of identifying mass response by a computer will be stored in a separate location from your responses. Absolute confidentiality of data provided through the Internet cannot be guaranteed due to the limited protections of Internet access. Please be sure to log out and close your browser when finished so no one will be able to see what you have been doing. I also encourage you to not complete this survey in a public setting. What if I want to leave the study? You have the right to refuse to participate or to withdraw at any time, without penalty. If you do withdraw from this study, it will not affect you in any way. If you choose to withdraw, you may request that any of your data which has been collected be destroyed unless it is in a unidentifiable state. Participation or non-participation in this study will not influence academic or medical services that are related to your child. What about new information/changes in the study? If significant new information relating to the study becomes available which may relate to your willingness to continue to participate, this information will be provided to you. Voluntary Consent by Participant: By signing this consent form you are agreeing that you have read, or it has been read to you, and you fully understand the contents of this document and are openly willing consent to take part in this study. All of your questions concerning this study have been answered. By signing this form, you are agreeing that you are 18 years of age or older and are agreeing to participate, or have the individual specified above as a participant participate, in this study described to you by Stephanie Gardiner-Walsh. To print this document: Consent to Participate

- ❍ I agree to participate (1)
- ❍ I do not agree to participate (2)

Q87 How did you find out about this study?

- ❑ A poster at a public library (1)
- ❑ A poster on a public bulletin board (2)
- ❑ Facebook (3)
- ❑ Reddit (4)
- ❑ Hands and Voices (5)
- ❑ Through a friend (6)
- ❑ Through a professional (7)
- ❑ Other (8) ____________________

Q50 My child with hearing loss is:

- ❍ Male (1)
- ❍ Female (2)
- ❍ Trans-gender / multigender (3)
- ❍ Other (4) ____________________

Q48 What is the child/student's race?

- ❍ White/ Caucasian (1)
- ❍ Black or African American (2)
- ❍ American Indian or Alaska Native (3)
- ❍ Asian (4)
- ❍ Native Hawaiian or Other Pacific Islander (5)
- ❍ Multiracial (6)
- ❍ Prefer not to respond (7)
- ❍ Other (8) ____________________

Q49 What ethnicity is the child/student?

- ❍ Hispanic/ Latino (1)
- ❍ Not Hispanic/Latino (2)
- ❍ Other (3) ____________________

Q69 Does your child have additional disabilities to hearing loss?

- ❍ Yes (1)
- ❍ No (2)

Q78 What additional disability(s) does your child with hearing loss have?

Q4 What is your relationship to the student/child with hearing loss?

- ❍ Mother (1)
- ❍ Father (2)
- ❍ Self (4)
- ❍ Other (3) ____________________

Q1 What is the primary language spoken in your home (i.e., the one you speak most of the time)?

- ❍ English (1)
- ❍ Spanish (2)
- ❍ Chinese (Cantonese or Mandarin) (3)
- ❍ French (4)
- ❍ Vietnamese (5)
- ❍ Arabic (6)
- ❍ Japanese (7)
- ❍ Tagalog (8)
- ❍ American Sign Language (9)
- ❍ Signed Exact English (11)
- ❍ Other (specify) (10) ____________________

Q60 Are any other language (s) spoken in your home?

- ❑ English (1)
- ❑ Spanish (2)
- ❑ Chinese (Cantonese or Mandarin) (3)
- ❑ French (4)
- ❑ Vietnamese (5)
- ❑ Arabic (6)
- ❑ Japanese (7)
- ❑ Tagalog (8)
- ❑ American Sign Language (9)
- ❑ Signed Exact English (12)
- ❑ Other (specify) (10) ____________________
- ❑ No other language from primary language (11)

Q9 Please indicate the current household income in U.S. dollars in which the child/student with hearing loss dwells.

- ❍ Rather not say (1)
- ❍ Under $10,000 (2)
- ❍ $10,000 - $19,999 (3)
- ❍ $20,000 - $29,999 (4)
- ❍ $30,000 - $39,999 (5)
- ❍ $40,000 - $49,999 (6)
- ❍ $50,000 - $74,999 (7)
- ❍ $75,000 - $99,999 (8)
- ❍ $100,000 - $150,000 (9)
- ❍ Over $150,000 (10)

Q3 Please indicate the highest level of education completed by the MOTHER of the child/student with hearing loss.

- ❍ Grammar School (K-8) (1)
- ❍ High School or equivalent (2)
- ❍ Career Training/ Trade School (Certificate only) (3)
- ❍ Vocational/Technical/Community College (Associate Degree) (4)
- ❍ Some College (5)
- ❍ College Graduate (4 year) (6)
- ❍ Master's Degree (7)
- ❍ Doctoral Degree (PhD) (8)
- ❍ Professional Degree (MD, JD, etc.) (9)
- ❍ Unknown (10)
- ❍ Other (11) ____________________

Q38 Please indicate the highest level of education completed by the FATHER of the child/student with hearing loss.

- ❍ Grammar School (K-8) (1)
- ❍ High School or equivalent (2)
- ❍ Career Training/ Trade School (Certificate only) (3)
- ❍ Vocational/Technical School/ Technical (Associate Degree) (4)
- ❍ Some College (5)
- ❍ College Graduate (4 year) (6)
- ❍ Master's Degree (7)
- ❍ Doctoral Degree (PhD) (8)
- ❍ Professional Degree (MD, JD, etc.) (9)
- ❍ Unknown (10)
- ❍ Other (11) ____________________

Q5 What is the household setting where the child primary resides?

- Two Parent Family (2)
- Single Parent (3)
- Widowed Parent (4)
- Blended Family (combined family/step family) (5)
- Multiple Generation Family (Grandparents, Parents, Children) (6)
- Foster Care (10)
- Group Home (11)
- Other (9) ____________________
- Rather not say (1)

Q6 Which STATE are you currently residing?

- Alabama (12)
- Alaska (13)
- Arizona (14)
- Arkansas (15)
- California (16)
- Colorado (17)
- Connecticut (18)
- Delaware (19)
- Florida (20)
- Georgia (21)
- Hawaii (22)
- Idaho (23)
- Illinois (24)
- Indiana (25)
- Iowa (26)
- Kansas (27)
- Kentucky (28)
- Louisiana (29)
- Maine (30)
- Maryland (31)
- Massachusetts (32)
- Michigan (33)
- Minnesota (34)
- Mississippi (35)
- Missouri (36)
- Montana (37)
- Nebraska (38)
- Nevada (39)
- New Hampshire (40)
- New York (41)
- New Jersey (42)
- New Mexico (43)
- North Carolina (44)
- North Dakota (45)
- Ohio (46)
- Oklahoma (47)
- Oregon (48)
- Pennsylvania (49)
- Rhode Island (50)
- South Carolina (51)
- South Dakota (52)
- Tennessee (53)
- Texas (54)
- Utah (55)
- Vermont (56)
- Virginia (57)
- Washington (58)
- West Virginia (59)
- Wisconsin (60)
- Wyoming (61)
- Washington, D.C. (63)
- Other/Outside of the US (62)

Q73 If living outside of United States, what PROVIDENCE/STATE and COUNTRY do you live in?

Q7 In which community setting do you reside?

- Urban (1)
- Suburban (2)
- Rural (3)
- Town (4)

Q8 How many adults AND children live in your household?

- 2 (1)
- 3 (2)
- 4 (3)
- 5 (4)
- 6 or more (5) ____________________

Q65 What grade is your child currently attending?

- Kindergarten (1)
- Grade 1 (2)
- Grade 2 (3)
- Grade 3 (4)
- Grade 4 (5)
- Grade 5 (6)
- Grade 6 (7)
- Grade 7 (8)
- Grade 8 (9)
- Grade 9/ Freshman Year (10)
- Grade 10/ Sophomore Year (11)
- Grade 11/ Junior Year (12)
- Grade 12/ Junior Year (13)
- Graduated High School (14)

Q45 How many schools has your child/student attended?

_______ Preschool (1)
_______ Kindergarten- Grade 5 (2)
_______ Grade 6-8 (3)
_______ High School 9-12 (4)

Q44 What size school did your child attend?

_______ Preschool (1)
_______ Kindergarten-Grade5 (2)
_______ Middle Grades: Grade 6-8 (3)
_______ High School: Grades 9-12 (4)

Q42 Has your child/student repeated a grade?

- Yes (1)
- No (2)
- I don't know (3)

Q82 Has your child/student dropped out of school?

- Yes (1)
- No (2)

Q43 Indicate any grades that your child/ student has repeated

- ❑ Kindergarten (1)
- ❑ Grade 1 (2)
- ❑ Grade 2 (3)
- ❑ Grade 3 (4)
- ❑ Grade 4 (5)
- ❑ Grade 5 (6)
- ❑ Grade 6 (7)
- ❑ Grade 7 (8)
- ❑ Grade 8 (9)
- ❑ Grade 9/ Freshman Year (10)
- ❑ Grade 10/ Sophomore Year (11)
- ❑ Grade 11/ Junior Year (12)
- ❑ Grade 12/ Junior Year (13)

Q83 When did your child/student leave school?

- ❍ Grade 8 (1)
- ❍ Grade 9 (2)
- ❍ Grade 10 (3)
- ❍ Grade 11 (4)
- ❍ Grade 12 (5)

Q27 The next few questions will ask you to compare your child to others of his/her age group. In order to compare to the correct age group, which grade levels best describe your child?

- ❍ Grades K-2 (1)
- ❍ Grades 3-8 (2)
- ❍ Grades 9-12 (3)

RS5 When called upon and asked a question, how often does your child appear to have been attending/listening? (How often does he/she understand the basis of question?)

	Always (5)	Most of the Time (4)	Sometimes (3)	Rarely (2)	Never (1)	I don't know (0)
Question Understanding (1)	❍	❍	❍	❍	❍	❍

RS6 How successful is your child at avoiding distraction by noises, visual distractions, personal items, or activities unrelated to instruction or conversation?

	Always (5)	Most of the Time (4)	Sometimes (3)	Rarely (2)	Never (1)	I don't know (0)
Avoids distractions (1)	❍	❍	❍	❍	❍	❍

RS7 How does your child's attention to detail compare to class/peer expectations?

	Above Average (5)	Slightly Average (4)	Average (3)	Below Average (2)	Well Below Average (1)	I don't know (0)
Avoids Careless Mistakes (1)	❍	❍	❍	❍	❍	❍

RS1 How does your child's reading level compare to the difficulty of work expected in classes?

	One of the Best (5)	Above Average (4)	Average (3)	Below Average (2)	One of the Worst (1)	I don't know (0)
Reading Ability (1)	❍	❍	❍	❍	❍	❍

RS2 How does your child's ability to summarize and draw conclusions about information presented in class compare to his/her class peers?

	One of the Best (5)	Above Average (4)	Average (3)	Below Average (2)	One of the Worst (1)	I don't know (0)
Ability to Summarize (1)	❍	❍	❍	❍	❍	❍

RS3 How does your child's demonstration of academic skill growth compare to class peers/expectations?

	One of the Best (5)	Above Average (4)	Average (3)	Below Average (2)	One of the Worst (1)	I don't know (0)
Academic Growth (1)	❍	❍	❍	❍	❍	❍

RS9 How well does your child communicate his/her needs to the teacher/parent in comparison to peers/expectations?

	Well Above Average (5)	Above Average (4)	Average (3)	Below Average (2)	Well Below Average (1)	I don't know (0)
Communicates Needs (1)	❍	❍	❍	❍	❍	❍

RS10 How does your child's word usage skills compare to children of the same age?

	Well Above Average (5)	Above Average (4)	Average (3)	Below Average (2)	Well Below Average (1)	I don't know (0)
Vocabulary (1)	❍	❍	❍	❍	❍	❍

RS11 What is your estimate of your child's ability to understand teacher instruction without help in comparison to peers?

	Well Above Average (5)	Above Average (4)	Average (3)	Below Average (2)	Well Below Average (1)	I don't know (0)
Assimilate Information (1)	❍	❍	❍	❍	❍	❍

RS14 In comparison to children of the same age, what is your child's present level of meaningful contribution to classroom discussion or group discussions?

	Above Average (5)	Slightly Average (4)	Average (3)	Below Average (2)	Well Below Average (1)	I don't know (0)
Contribution to Discussion (1)	❍	❍	❍	❍	❍	❍

RS15 To what level does your child demonstrate a recognition that participation is an integral part of the learning process?

	Much Better (5)	Better (4)	Average (3)	Somewhat Worse (2)	Worse (1)	I don't know (0)
Understands need to participate (1)	❍	❍	❍	❍	❍	❍

Q67 To what extent does your child understand the need to advocate for his/her needs in the classroom?

	Very Strong Understanding; Advocates frequently (5)	Has a strong understand and will advocate sometimes (4)	Understands Need, Does not Advocate (3)	Understands some, Does not advocate (2)	Does not understand (1)	I don't know (0)
Understands need to advocate (1)	❍	❍	❍	❍	❍	❍

RS16 During cooperative group activities, how often does your child interact with others to achieve the goals of group work?

	Frequently (5)	Sometimes (4)	Occasionally (3)	Rarely (2)	Never (1)	I don't know (0)
Participates in Group work (1)	❍	❍	❍	❍	❍	❍

RS17 How often does the student demonstrate respectful behavior towards others in the class (peers and teachers)?

	All of the time (5)	Often (4)	Sometimes (3)	Rarely (2)	Never (1)	I don't know (0)
Respectful Behavior (1)	❍	❍	❍	❍	❍	❍

RS18 How often does the student follow classroom rules compared to peers?

	All of the Time (5)	Often (4)	Sometimes (3)	Rarely (2)	Never (1)	I don't know (0)
Follows Rules (1)	❍	❍	❍	❍	❍	❍

RS19 To what level does the student appear to have relationships with his/her peers?

	Highly Accepted/ Popular (5)	Many Friends (4)	Average (3)	Few Friends (2)	Isolated (1)	I don't know (0)
Peer Relationships (1)	❍	❍	❍	❍	❍	❍

RS1 What is your estimate of your child's class standing in comparison of that of his/her classmates?

	Upper (5)	Upper Middle (4)	Middle (3)	Lower Middle (2)	Lower (1)	I don't know (0)
Class Rank (1)	❍	❍	❍	❍	❍	❍

RS2 How does your child's achievement compare to your estimation of his/her potential?

	Equal to Potential (5)	Slightly below Potential (4)	Lower than Potential (3)	Below Potential (2)	Very Below Potential (1)	I don't know (0)
Performance to Potential (1)	❍	❍	❍	❍	❍	❍

RS3 What is your child's reading level, reading ability group, or reading readiness group in the classroom?

	Advanced Reading Group (5)	High Reading Group (4)	Average Reading Group (3)	Low Reading Group (2)	Lowest Reading Group (1)	I don't know (0)
Reading Group (1)	❍	❍	❍	❍	❍	❍

RS5 How distractible is your child in comparison to children of the same age?

	Not Very Distractible (5)	Somewhat Distractible (4)	Average Distractibility (3)	Often Distracted (2)	Very Distractible (1)	I don't know (0)
Distractibility (1)	❍	❍	❍	❍	❍	❍

RS6 What is your child's attention span in comparison to that of children the same age?

	Longer than Peers (5)	Slightly more than Average (4)	Average Attention (3)	Short Attention (2)	Very Short (1)	I don't know (0)
Attention Span (1)	❍	❍	❍	❍	❍	❍

RS7 How often does your child hesitate or become confused when responding to SPOKEN DIRECTIONS?

	Always (5)	Most of the Time (4)	Sometimes (3)	Rarely (2)	Never (1)	I don't know (0)
Confused with Directions (1)	❍	❍	❍	❍	❍	❍

RS9 How does your child's comprehension of instruction n compare to the average understanding ability of his/her classmates?

	Well Above Average (5)	Above Average (4)	Average (3)	Below Average (2)	Well Below Average (1)	I don't know (0)
Understanding (1)	❍	❍	❍	❍	❍	❍

RS10 How does your child's vocabulary and word usage skills compare with those of other students in his/her age group?

	Well Above Average (5)	Above Average (4)	Average (3)	Below Average (2)	Well Below Average (1)	I don't know (0)
Vocabulary (1)	❍	❍	❍	❍	❍	❍

RS11 How proficient is your child at telling a story or relating happenings from home/school to other situations compared to peers?

	Well Above Average (5)	Above Average (4)	Average (3)	Below Average (2)	Well Below Average (1)	I don't know (0)
Story Telling Ability (1)	❍	❍	❍	❍	❍	❍

RS14 How often does your child volunteer information to discussions or answer questions in a group?

	Always (5)	Most of the Time (4)	Sometimes (3)	Rarely (2)	Never (1)	I don't know (0)
Voluntary Participation in Discussion (1)	❍	❍	❍	❍	❍	❍

RS15 With what frequency does your child complete his/her homework assignments within time allocated?

	Always (5)	Most of the Time (4)	Sometimes (3)	Rarely (2)	Never (1)	I don't know (0)
Homework Complete (1)	❍	❍	❍	❍	❍	❍

RS16 After instruction, does your child have difficulty starting to work (i.e. looking at others or asking for help)?

	Frequently (5)	Sometimes (4)	Occasionally (3)	Rarely (2)	Never (1)	I don't know (0)
Needs Help (1)	❍	❍	❍	❍	❍	❍

RS17 Does your child demonstrate any behaviors that seem unusual or inappropriate compared to other children the same age?

	All of the Time (5)	Often (4)	Sometimes (3)	Rarely (2)	Never (1)	I don't know (0)
Behavior (1)	❍	❍	❍	❍	❍	❍

Q68 How often will your child advocate for his/her needs in the classroom?

	Frequently (5)	Sometimes (4)	Occasional (3)	Rarely (2)	Never (1)	I don't know (0)
Self Advocacy (1)	❍	❍	❍	❍	❍	❍

RS18 Does your child become frustrated easily, sometimes to the point of losing emotional control?

	All of the Time (1)	Often (2)	Sometimes (3)	Rarely (4)	Never (5)	I don't know (6)
Frustration Level (1)	❍	❍	❍	❍	❍	❍

RS19 In general, how would you rank your child's relationship with peers (ability to get along with others)?

	Very Strong (5)	Good (4)	Neither Good nor Bad (3)	Fair (2)	Poor (1)	I don't know (0)
Peer Relationships (1)	❍	❍	❍	❍	❍	❍

Q12 How old was the child/student when his/her hearing loss was detected?

- ❍ Birth-6 months (1)
- ❍ 6 to 12 months (2)
- ❍ 1 year old (3)
- ❍ 2 years old (6)
- ❍ 3 years old (7)
- ❍ 4 years old (8)
- ❍ 4 years old (9)
- ❍ 6 years old (10)
- ❍ Other (type age) (5) ____________________

Q61 Was the hearing loss present at birth?

- ❍ Yes (1)
- ❍ No, it was acquired (2)
- ❍ Unknown (3)

Q39 How was hearing loss first detected?

- ❍ Newborn Hearing Screening (1)
- ❍ Parent/Family member concern (2)
- ❍ Doctor Concern (3)
- ❍ School Referral (4)

Q59 What is the cause (etiology) of hearing loss?

- ❍ Unknown (1)
- ❍ Birth Trauma, Rh factor, Pre-maturity (2)
- ❍ Illness (measles, mumps, rubella, high fever, etc.) (3)
- ❍ Chronic Infection (4)
- ❍ Genetic/ Inherited (5)
- ❍ Medication (chemotherapy, antibiotics, etc.) (6)
- ❍ Other: (7) ____________________

Q14 What services or supports has the child/student with hearing loss received in the past? (Check all that have apply).

- ❑ Hearing Aids(s) (1)
- ❑ Amplification System (FM system, speakers in classroom) (2)
- ❑ Early Intervention Services (3)
- ❑ Special school services (special education, hearing services) (4)
- ❑ Modifications in School (seating close to teacher, teacher notes, etc) (5)
- ❑ Don't know (6)
- ❑ No hearing loss present in the past. (9)
- ❑ None. No services were used. (7)
- ❑ Other (8) ____________________

Q62 Did the child use his/her amplification (hearing aids, FM system) all or most of the time?

- ❍ Yes, he/she used all of the recommended amplification (1)
- ❍ Yes, he/she used some of recommended amplification systems (2)
- ❍ No he/she did not use recommended amplification regularly (3)
- ❍ Hearing loss was not present in the past. (4)

Q41 What services or supports does the child/student CURRENTLY receive? (Check all that apply).

- ❑ Hearing Aids(s) (1)
- ❑ Amplification System (FM system, speakers in classroom) (2)
- ❑ Early Intervention Services (3)
- ❑ Special school services (special education, hearing services) (4)
- ❑ Modifications in School (seating close to teacher, teacher notes, etc.) (5)
- ❑ Don't know (6)
- ❑ None (7)
- ❑ Other (8) ____________________

Q64 Does the child NOW use his/her amplification (hearing aids, FM system) all or most of the time?

- ❍ Yes, he/she uses all of the recommended amplification systems (1)
- ❍ Yes, he/she uses some of the recommended amplification systems (2)
- ❍ No, he/ she does not use recommended amplification regularly (3)

Q15 How is the child served in school?

- ❍ Regular Education with no support (1)
- ❍ Regular Education +504 Plan (2)
- ❍ Regular Education + Special Education Services (IEP) (3)
- ❍ Resource or Self-Contained with IEP (4)
- ❍ Unknown (5)
- ❍ Other (6) ____________________

Q79 What type of hearing loss does your child have?

- ❍ Mild Hearing Loss (both ears) (1)
- ❍ Mild to Moderate Hearing Loss (both ears) (4)
- ❍ High Frequency Hearing Loss (both ears) (8)
- ❍ Unilateral Hearing Loss (Left Ear ONLY) (2)
- ❍ Unilateral Hearing Loss (Right Ear ONLY) (3)
- ❍ Other Hearing Loss (both ears) (7)
- ❍ I don't know (10)

Q80 How often do you follow up with a doctor or audiologist about the hearing loss?

- More than once a year (1)
- Once a year (2)
- Every other year (3)
- Very rarely (4)
- Never (5)

Q88 For the following 2 questions YOU WILL NEED to use your child's audiogram to enter data. This is to confirm their type of hearing loss. Please enter your child's most recent audiogram into the response below. Some of the data from your audiogram might not be used, as some audiologists provide more data for their own accuracy. Some of the data on this audiogram may not be on the audiogram provided. If a requested item was not recorded, choose the response "UNABLE TO PROVIDE" located at the bottom of the audiogram. Date of Audiogram MM/DD/YYYY or N/A

Left For the following 2 questions YOU WILL NEED to use your child's audiogram to enter data. Please enter your child's most recent audiogram into the response below. Some of the data from your audiogram might not be used, as some audiologists provide more data for their own accuracy. Some of the data on this audiogram may not be on the audiogram provided.TO THE BEST OF YOUR ABILITY enter ONE DOT PER COLUMN to match your child's audiogram.LEFT Ear (This will be shown by an X on your child's audiogram. The X might be blue).

	250 (250)	500 (500)	1000 (1000)	2000 (2000)	4000 (4000)	8000 (8000)
-10 (1)	❑	❑	❑	❑	❑	❑
0 (2)	❑	❑	❑	❑	❑	❑
10 (3)	❑	❑	❑	❑	❑	❑
15 (4)	❑	❑	❑	❑	❑	❑
20 (5)	❑	❑	❑	❑	❑	❑
25 (6)	❑	❑	❑	❑	❑	❑
30 (7)	❑	❑	❑	❑	❑	❑
35 (8)	❑	❑	❑	❑	❑	❑
40 (9)	❑	❑	❑	❑	❑	❑
45 (10)	❑	❑	❑	❑	❑	❑
50 (11)	❑	❑	❑	❑	❑	❑
55 (12)	❑	❑	❑	❑	❑	❑
60 (13)	❑	❑	❑	❑	❑	❑
65 (14)	❑	❑	❑	❑	❑	❑
70 (15)	❑	❑	❑	❑	❑	❑
75 (16)	❑	❑	❑	❑	❑	❑
80 (17)	❑	❑	❑	❑	❑	❑
85 (18)	❑	❑	❑	❑	❑	❑
90 (19)	❑	❑	❑	❑	❑	❑
95 (20)	❑	❑	❑	❑	❑	❑
(21)	❑	❑	❑	❑	❑	❑
Unable to provide	❑	❑	❑	❑	❑	❑

(22)						

Right TO THE BEST OF YOUR ABILITY enter ONE DOT PER COLUMN to match your child's audiogram.RIGHT Ear (This will be shown by an O on your child's audiogram. The O might be RED)

	250 (250)	500 (500)	1000 (1000)	2000 (2000)	4000 (4000)	8000 (8000)
-10 (1)	❑	❑	❑	❑	❑	❑
0 (2)	❑	❑	❑	❑	❑	❑
10 (3)	❑	❑	❑	❑	❑	❑
15 (4)	❑	❑	❑	❑	❑	❑
20 (5)	❑	❑	❑	❑	❑	❑
25 (6)	❑	❑	❑	❑	❑	❑
30 (7)	❑	❑	❑	❑	❑	❑
35 (8)	❑	❑	❑	❑	❑	❑
40 (9)	❑	❑	❑	❑	❑	❑
45 (10)	❑	❑	❑	❑	❑	❑
50 (11)	❑	❑	❑	❑	❑	❑
55 (12)	❑	❑	❑	❑	❑	❑
60 (13)	❑	❑	❑	❑	❑	❑
65 (14)	❑	❑	❑	❑	❑	❑
70 (15)	❑	❑	❑	❑	❑	❑
75 (16)	❑	❑	❑	❑	❑	❑
80 (17)	❑	❑	❑	❑	❑	❑
85 (18)	❑	❑	❑	❑	❑	❑
90 (19)	❑	❑	❑	❑	❑	❑
95 (20)	❑	❑	❑	❑	❑	❑
(21)	❑	❑	❑	❑	❑	❑
Unable to provide (22)	❑	❑	❑	❑	❑	❑

Q84 Is there anything else you would like to say about your child or this survey?

APPENDIX C

PERL SCRIPT

```
use Switch;
print "ID,250,500,1K,2K,4K,8K,ArtIndex\n";
 open(ReportFile,"<","Dist.csv") or die "FALE";
        $Rawline=<ReportFile>;
my @Audio;
while ($Rawline) {
               @SplitLine = split(',',$Rawline);
                         print $SplitLine[0],",";
                         &PrintAudio(49);
                         print ",";
                         &PrintAudio(173);
                         $Rawline=<ReportFile>;
               print "\n";                    }
sub PrintAudio{
            my @Audio = ();
            $base = $_[0];
            for(my $y = 0;$y<=5;$y++){
                        for (my $x = $base+$y;$x<=$base+123+$y;$x+=6){
                                    #print $x,"< $y\n";
                                    if($SplitLine[$x] =~ /1/){
                                                my $Temp = ($x-1)/6;
                                                switch(int( $Temp )) {
            case 8  {$Temp2           =-10}               case 9  {$Temp2 = 0}                case 10
{$Temp2 = 10}
```

```
        case 11 {$Temp2 = 15}        case 12 {$Temp2 = 20} case 13 {$Temp2 = 25}
        case 14 {$Temp2 = 30}        case 15 {$Temp2 = 35} case 16 {$Temp2 = 40}
        case 17 {$Temp2 = 45}        case 18 {$Temp2 = 50} case 19 {$Temp2 = 55}
        case 20 {$Temp2 = 60}        case 21 {$Temp2 = 65} case 22 {$Temp2 = 70}
        case 23 {$Temp2 = 75}        case 24 {$Temp2 = 80   case 25 {$Temp2 = 85}
        case 26 {$Temp2 = 90}        case 27 {$Temp2 = 95} case 28 {$Temp2 = 100}
        case 29 {$Temp2 = -10}       case 30 {$Temp2 = 0}   case 31 {$Temp2 = 10}
        case 32 {$Temp2 = 15}        case 33 {$Temp2 = 20} case 34 {$Temp2 = 25}
        case 35 {$Temp2 = 30}        case 36 {$Temp2 = 35} case 37 {$Temp2 = 40}
        case 38 {$Temp2 = 45}        case 39 {$Temp2 = 50} case 40 {$Temp2 = 55}
        case 41 {$Temp2 = 60}        case 42 {$Temp2 = 65} case 43 {$Temp2 = 70}
        case 44 {$Temp2 = 75}        case 45 {$Temp2 = 80} case 46 {$Temp2 = 85}
        case 47 {$Temp2 = 90}        case 48 {$Temp2 = 95} case 49 {$Temp2 = 100} }
                        $Audio[$y] = $Temp2;
                #       print $base," ",$Temp,"<",int(($x-1)/6),"<$x,$y\n",;
        }       }       print " ";      }
print   &GetArt(\@Audio);   }
sub GetArt{         my $Count = 0;
my @Freq = (250,500,1000,2000,4000,8000);       my @AudioGram = @{$_[0]} ;
#print @AudioGram;
my @Points = ( [250,15],    [250,25],    [250,35],    [333,18],    [333,28],
        [333,38],    [416,21],    [416,27],    [416,35],    [416,43],
        [500,25],    [500,32],    [500,38],    [500,45],    [583,23],
        [583,27],    [583,33],    [583,37],    [583,42],    [583,46],
        [800,23],    [800,27],    [800,33],    [800,37],    [800,42],
        [800,46],    [1000,22],   [1000,25],   [1000,29],   [1000,32],
        [1000,35],   [1000,39],   [1000,43],   [1000,48],   [1350,21],
```

```
        [1350,24],      [1350,28],      [1350,31],      [1350,34],      [1350,39],
        [1350,42],      [1350,45],      [1350,49],      [1700,21],      [1700,24],
        [1700,27],      [1700,29],      [1700,32],      [1700,33],      [1700,36],
        [1700,40],      [1700,42],      [1700,45],      [1700,48],      [2000,21],
        [2000,24],      [2000,27],      [2000,29],      [2000,32],      [2000,33],
        [2000,36],      [2000,40],      [2000,42],      [2000,45],      [2000,48],
        [2800,21],      [2800,24],      [2800,27],      [2800,29],      [2800,32],
        [2800,33],      [2800,36],      [2800,40],      [2800,42],      [2800,45],
        [2800,48],      [3200,21],      [3200,24],      [3200,27],      [3200,29],
        [3200,32],      [3200,33],      [3200,36],      [3200,40],      [3200,42],
        [3200,45],      [3200,48],      [4000,20],      [4000,23],      [4000,28],
        [4000,32],      [4000,35],      [4000,40],      [4000,43],      [5000,15],
        [5000,21],      [5000,25],      [5000,30],      [5000,35],      [5000,39]);
for $AudioPoint (0 .. $#Freq){
#print $Freq[$AudioPoint]," ";          }               #print "\n";
for $AudioPoint (0 .. $#AudioGram){
print $AudioGram[$AudioPoint],",";              }               print ",";
for $AudioPoint (1 .. $#AudioGram){
#$xAudio = ${$AudioGram[$AudioPoint]}[0];               #$yAudio =
${$AudioGram[$AudioPoint]}[1];
my $slope = ($AudioGram[$AudioPoint-1]-$AudioGram[$AudioPoint])/($Freq[$AudioPoint-1]-
$Freq[$AudioPoint]);
for $Point  (0 .. $#Points) {
        $xCur = ${$Points[$Point]}[0];
        $yCur = ${$Points[$Point]}[1];
        if($xCur >= $Freq[$AudioPoint-1] && $xCur < $Freq[$AudioPoint]){
        #       print $xCur," ",$yCur,"\n",$Freq[$AudioPoint-1]," ", $Freq[$AudioPoint],"
",$slope," ";
```

```
#       print $AudioGram[$AudioPoint-1]," ",$AudioGram[$AudioPoint-1]+(($xCur-$Freq[$AudioPoint-1])*$slope)," ",$AudioGram[$AudioPoint],"<\n";
        if ( $yCur > $AudioGram[$AudioPoint-1]+(($xCur-$Freq[$AudioPoint-1])*$slope)){
#               print "greater than\n";
                $Count++;               }               }       }}
return $Count;  }
```

APPENDIX D

INSTITUTIONAL REVIEW BOARD DOCUMENTATION

IRB Number: 14-0046 Modification Principal Investigator: Stephanie Gardiner-Walsh
Post Approval Submissions

Modification Information

Please proceed with your online modification as directed below. This requires the conversion of your full application to the online format. Basic information about your study from the existing IRB database has been carried forward; however, the majority of information from your paper application will need to be entered at this time.

To modify an approved study, edit the individual answers that make up the application. The questions below are intended solely for the IRB to have a summary statement of your requested action. The modifications cannot be
processed until the actual changes have been made throughout the application.

1.Provide a brief non-technical summary of any changes you will be making to the study in bullet points

Please make the appropriate changes to the applicable sections of the application. The text you enter here will be reproduced in the IRB approval document, and should contain the details that you find relevant (e.g., master protocol). .Typical summaries are 50-100 words. Include a list of any documents that have been modified or added. PLEASE NOTE: THIS SECTION MAY BE EDITED BY THE IRB FOR CLARITY OR LENGTH.

When I activated the Qualtrics survey, the redirect link broke. The redirect service does not allow me to edit the link I have shortened. I have had to recreate the shortened URL on the flyers for distribution. This is the only change. The only change made is the website on the flyers.

2.Is this modification being submitted in response to an unanticipated problem/adverse event or new findings?

No

3.Does this modification involve new information that requires re-consent of CURRENT subjects?

No

4.Is this study permanently closed to enrollment of subjects, all interventions and follow-up complete, and
open for DATA ANALYSIS ONLY?

No

Continuing with Modifications

If the application for this study was created ONLINE, you will have access to your existing application. Click "save and continue."

If the application for this study is currently on PAPER:

This requires the conversion of your full application to the online format. Basic information about your study from the existing IRB database has been carried forward; however, the majority of information from your paper application will need to be entered at this time. You may make any changes to the application that you are requesting at this time. Consent forms that currently exist on paper can be cut and pasted into the consent form editor. More details will be provided in the "Consent Forms" section.

For additional guidance in converting your paper application, click here.

General Information

1. General Information

1.Project Title

Factors characterizing the academic experience of children with mild bilateral or unilateral hearing loss: A dissertation study

IRB Number: 14-0046 Principal Investigators: Stephanie Gardiner-Walsh

2.Brief Summary. Provide a brief non-technical description of the study, which will be used in documentation as a description of the study. Typical summaries are 50-100 words. Please reply to each item below, retaining the subheading labels already in place, so that reviewers can readily identify the content.

PLEASE NOTE: THIS SECTION MAY BE EDITED BY THE IRB FOR CLARITY OR LENGTH.

The purpose of this qualitative research study is to identify any possible differences in characteristics
which may be useful in aiding current teachers and medical professionals in identifying children with mild bilateral or unilateral hearing loss (MB/UHL) who may be most at risk for academic failure.
These factors will be identified through parent survey with the hope that academic support services
can be provided in a manner to improve outcomes for children with mild bilateral and unilateral hearing loss.

3.Is there anything else you would like the IRB to know about this study
This study is the follow up to the pilot study (IRB ID:13-0250/ Reference ID:100386) approved in August 2014. .

2. Project Personnel

1.Will this be a STUDENT'S research (undergraduate, graduate) for the purposes of the fulfillment of requirements for a University course or program?
Yes

This study will require any student who is planning to lead the research project to assign themselves as the Role of Principal Investigator, however any student-led projects will require a Faculty Advisor and that advisor's oversight and sign-off on IRB applications. This should be the Faculty member who will mentor this research, who may or may not be your academic Faculty Advisor.
The Faculty Advisor will remain responsible for the conduct of the research and the storage of the data, as is the current UNCG policy.
The Faculty Advisor will be required to co-certify with the student PI. You should also make sure this person has a chance to review and edit the submission before you submit.

Please choose the type of research the student is proposing: Dissertation

2.List all project personnel beginning with principal investigator, followed by faculty advisor, co-investigators
study coordinators, and anyone else who has contact with subjects or identifiable data from subjects. STUDENTS CANNOT BE CO-PI'S.

List ONLY those personnel for whom this IRB will be responsible; do NOT include collaborators who will remain under the oversight of another IRB for this study.
If this is Community Based Participatory Research (CBPR) or you are otherwise working with community partners (who are not functioning as researchers), you may not be required to list them here as project personnel; consult with your IRB.

If your extended research team includes multiple individuals with limited roles, you may not be required to list them here as project personnel; consult with your IRB.

The table below will access campus directory information; if you do not find your name, your directory listing may need to be updated.

Last Name First Name Department Name Role Detail
Gardiner-Walsh, Stephanie, Specialized Education Services, Principal Investigator
Compton, Mary, Specialized Education Services, Faculty Advisor

3.Have all PI's and/or Student Investigators completed human subjects training through CITI or UNCG-ORI

IRB Number: 14-0046 Modification Principal Investigator: Stephanie Gardiner-Walsh

3.Have all PI's and/or Student Investigators completed human subjects training through CITI or UNCG- sessions? (only CITI Researcher or Student Researcher modules and/or UNCG training are accepted). The ORI office can verify CITI completion, however UNCG training or other training will need to be attached. PLEASE NOTE: Research Assistants and non-investigators engaged in data collection need to have valid human subjects training on file with PI)
Yes

4.At any time, will members of the research team or their immediate family members have financial interest in receive personal compensation from, or hold a position in an industry sponsoring this study or otherwise have a potential conflict of interest regarding the conduct of this study? If no, please state "no"
No

3. Funding Sources

1.Is this project funded (or proposed to be funded) by a contract or grant from an organization external to UNCG?
No

2.Is there Department of Health and Human Services (DHHS) grant application supporting this submission?
No

4. Screening Questions

The following questions will help you determine if your project will require IRB review and approval.
The first question is to determine whether this is RESEARCH

1.Does your project involve a systematic investigation, including research development, testing and evaluation, which is designed to develop or contribute to generalizable knowledge? PLEASE NOTE: You should only answer yes if your activity meets all the above.
Yes

The next questions will determine if there are HUMAN SUBJECTS
2.Will you be obtaining information about a living individual through direct intervention or interaction with that individual? This would include any contact with people using questionnaires/surveys, interviews, focus groups, observations, treatment interventions, etc. PLEASE NOTE: Merely obtaining information FROM an individual does not mean you should answer 'Yes,' unless the information is also ABOUT them.
Yes

The following questions will help build the remainder of your application.
3.Are any personnel, organizations, entities, facilities or locations in addition to UNCG engaged in this

research (e.g., is this a multi-site study or does it otherwise involve locations outside UNCG, including foreign locations)? PLEASE NOTE: This does NOT include the sites you are recruiting from.

No

Exemptions

Request Exemption

Some research involving human subjects may be eligible for an exemption which would result in fewer application and review requirements. This would not apply in a study that involves greater than minimal risk, or involves medical procedures or deception or minors, except in limited circumstances.

Additional guidance is available at ORI IRB . Exemptions can be confusing; if you have not completed this page before, please review this table with definitions and examples before you begin.

1.Would you like your application evaluated for a possible exemption
Yes

Will your study either involve prisoners as participants or be FDA-regulated
No

Category 1 (click here for guidance and examples
The research is to be conducted in established or commonly accepted educational settings. Note: This applies to the location where education research will actually be conducted (e.g., public schools) and NOT to your location at a university.
And the research will involve normal educational practices, such as
Research on regular and special education instructional strategies
Research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

Category 2: (click here for guidance and examples
Does your study involve minors under the age of 18?
No

The research involves the use of one or more of the following
Educational tests (cognitive, diagnostic, aptitude, achievement).
Survey procedures.
Interview procedures
Observation of public behavior.
And either or both of the following is true:

The information to be obtained will be recorded in such a manner that participants cannot be identified, directly or indirectly through identifiers linked to the participants.
Any disclosure of the participants' responses outside the research would not reasonably place the participants at risk of criminal or civil liability or be damaging to the participants' financial standing, employability, or reputation.

Category 3 (click here for guidance and examples)
Research involves the use of one or more of the following:

Educational tests (cognitive, diagnostic, aptitude, achievement).
Survey procedures.
Interview procedures
Observation of public behavior.

And

The participants are elected or appointed public officials or candidates for public office.

Federal statute(s) require(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.

Explain:
Confidentiality will be maintained through a password protected data access site and through a locked filing system within the GA lab, 4th floor SOE building.

Category 4 (click here for guidance and examples)
The research involves the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens.
And either of the following is true:
The sources of data are publicly available.
The investigator records information in such a manner that participants cannot be identified, directly or indirectly through identifiers linked to the participants.

Explain
Survey data collected through Qualtrics has no name, email, or address identification. IP data is collected for the purpose of data removal if a participant wishes to withdraw from the study. IP data is stored in a separate location from data and is coded for anonymity.

Category 5 (click here for guidance and examples)
The project is a research or demonstration project.
Additionally the following must also be true.
The program under study delivers a public benefit (e.g., financial or medical benefits as provided under the Social Security Act) or service (e.g., social, supportive, or nutrition services as provided under the Older Americans Act).
The research is conducted pursuant to specific federal statutory authority.
There is no statutory requirement that an IRB review the research.
The research does not involve significant physical invasions or intrusions upon the privacy of participants.
The research is designed to study, evaluate, or otherwise examine one or more of the following:

Public benefit or service programs.
Procedures for obtaining benefits or services under those programs.
Possible changes in or alternatives to those programs or procedures.
Possible changes in methods or levels of payment for benefits or services under those programs.

Explain
The researcher does not have contact with the participants while completing the survey.

Part A. Questions Common to All Studies

A.1. Background and Rationale

1.Provide a summary of the background and rationale for this study (i.e,, why is the study needed?). Do NOT exceed one paragraph. Do NOT include a literature review. (If there is an accompanying DHHS grant application, please attach it to this application).

Students with mild bilateral (MBHL) or unilateral hearing loss (UHL) are frequently overlooked in service provision under special education service provision as they are typically viewed as having insignificant disability (Brown, Holstrum, & Ringwalt, 2008). However, around 50% of these students fail at least one grade during their K-12 experience, demonstrating a significant risk associated with this population (Fred H. Bess & Tharpe, 1984; F. H. Bess & Tharpe, 1986; Most, 2006). Despite evidence of risk for failure, little research exists to aid in the identification of need for services, including risk factors or potential risk factors. The aim of this study is to fill that gap of evidence required to better identify students who may need interventions to prevent failure academically. In short, this study is an analysis of demographic and student characteristics used to identify common traits among students with MB/UHL who are likely to be associated with failure in academic performance.

A.2. Subjects

1.Total number of subjects to be studied by the UNCG investigator(s) (provide exact number):
150

2.Do you have specific plans to enroll subjects from these vulnerable or select populations

Children (under the age of majority for their location)

Note that you will be asked to provide age ranges for children in the Consent Process section.

Non-English-speaking

Decisionally impaired

UNCG Students

UNCG Employees

People who are likely to be involved in abusive relationships, either as perpetrator or victim

Prisoners, others involuntarily detained or incarcerated (this includes parolees held in treatment centers as a condition of their parole)

Pregnant women

Patients (i.e., have a specific disease, disorder or condition regardless of where they receive their healthcare)

HIV positive individuals

3.If any of the above populations are checked, please describe your plans to provide additional protections for these subjects

All data that is collected will be collected in an online survey where neither the parent nor the child refered to is identified beyond gender, age, and grade.

4.Age range of subjects:
Minimum age of subject enrolled 18 years
Maximum age of subject enrolled 99
» If no maximum age limit, indicate 99 years

A.4. Study design, methods and procedures
Your response to the next question will help determine what further questions you will be asked in the following sections.

1.Will you be using any methods or procedures commonly used in biomedical or clinical research (this would include but not be limited to drawing blood, performing lab tests or biological monitoring, or conducting physical exams)?
No

2.Describe the study design. List and describe study procedures, including a sequential description of what participants will be asked to do, when relevant.

Participants will be asked to complete a survey (attached) regarding demographic data about their child with mild bilateral or unilateral hearing loss. Additional data about parent perception of student success, student academic progress, and student hearing status will be conducted simultaneously using the SIFTER tool within the survey process (Screening instrument for targeting educational risk by Karen L. Anderson).

Data will be analyzed in two stages. First, univariate procedures will be conducted to find overall trends among variables. Secondly, a discriminant analysis will be conducted including step-wise comparisons to group participants by common characteristics according to dependent variable grouping.

3.Will this study use any of the following methods
Audiotaping
Videotaping or filming
Behavioral observation **-** (e.g., Participant, naturalistic, experimental, and other observational methods typically used in social science research)
Pencil and paper questionnaires or surveys
Electronic questionnaires or surveys
Telephone questionnaires or surveys
Interview questionnaires or surveys
Other questionnaires or surveys
Focus groups
Diaries or journals
Photovoice
Still photography
Other

Please explain--

4.If there are procedures or methods that require specialized training, describe who (role/qualifications) will be involved and how they will be trained. If not, state "n/a".

n/a

5.Are there cultural issues, concerns or implications for the methods to be used with this study population? If not, state "n/a".

No

6.Will this project also need to be reviewed by the Radiation Safety Committee (i.e. the use of the DXA)? If there is a possibility that any of the participants will be pregnant please see our SOP's section (7.5.19).

No

7.Will this study be utilizing the Experimetrix Psychology participant pool?

No

8.Does your study involve deception? If so, a debriefing script/information sheet needs to be attached.

No

A.6. Risks and measures to minimize risks

For each of the following categories of risk you will be asked to describe any items checked and what will be done to minimize the risks. Where possible, describe the likelihood of the risks occurring, using the following terms:

Very Common (approximate incidence > 50%)
Common (approximate incidence > 25%)
Likely (approximate incidence of 10-25%)
Infrequent (approximate incidence of 1-10%)
Rare (approximate incidence < 1%)

1.Psychological

Emotional distress
Embarrassment
Consequences of breach of confidentiality
Other

Describe any items checked above and what will be done to minimize these risks

It is unlikely that psychological risks will occur. Data that is provided by parents will be encrypted and randomized with no attachment of personal contact information. Breach of confidentiality (rare risk) will be minimized with these procedures. Network identification will be saved for the duration of the study so that parents wishing to retract their provided responses can be linked electronically. The data will be held in a separate location and does not contain personally identifiable information. Embarrassment and emotional distress (rare risk) will be minimalized through the lack of face to face contact. Contact information is provided for participants if questions or concerns about the study emerge.

2.Social

Loss of reputation or standing within the community
Harms to a larger group or community beyond the subjects of the study (e.g., stigmatization)
Consequences of breach of confidentiality
Other

Describe any items checked above and what will be done to minimize these risks

Minimal risks are predicted. Confidentiality is maintained through a double password encrypted data collection file. No identifiable information is collected beyond network identification keys.

3.Economic

Loss of income
Loss of employment or insurability
Loss of professional standing or reputation
Loss of standing within the community
Consequences of breach of confidentiality
Other

Describe any items checked above and what will be done to minimize these risks

No economic risks are predicted.

4.Legal

Disclosure of illegal activity
Disclosure of negligence
Consequences of breach of confidentiality
Other

Describe any items checked above and what will be done to minimize these risks

No legal risks are predicted.

5.Physical

Pain
Discomfort
Injury

Describe any items checked above, including the category of likelihood and what will be done to minimize these risks

No physical risks are predicted.

6.If relevant, describe procedures for providing a referral for any participants who are found, during the course of this study, to be in need of psychological counseling or medical follow-up. This would generally occur in studies where there are questions about depression or suicide or studies where there is potential for injury.

Not relevant to this study.

A.9. Identifiers

1.Will you be collecting Private Health Information (PHI)?

A.10. Confidentiality of the data

1.Describe procedures for maintaining confidentiality of the data you will collect or will receive (e.g., coding, anonymous responses, use of pseudonyms, etc.).

Responses to survey are confidential and completed without identifiable names. Any printed materials that are downloaded from Qualtrics will be kept in a locked cabinet in the graduate assistant lab. IP addresses will be stored in a separate, coded file to be accessed only if data is

requested to be retracted from the study. IP addresses are collected only to ensure there is not a bulk-response rate due to bot response.

2.Describe the procedures for storing the data (locked filing cabinet, password protected computer, on/off UNCG campus).

Data collected online is stored on an online server hosted by Qualtrics protected by password and encrypted during download into a password protected file server that is not publically accessible.

Hard copy data will be stored in a locked file cabinet in the graduate student office room 405 School of Education Building.

Part B. Direct Interaction

B.1. Methods of recruiting

1.Check all the following means/methods of subject recruitment to be used:*

In person
Participant pools
Presentation to classes or other groups
Letters
Flyers
Radio, TV recruitment ads
Newspaper recruitment ads
Website recruitment ads
Telephone script
Email or listserv announcements
Follow up to initial contact (e.g., email, script, letter)
Other

IRB Number: 14-0046 Modification Principal Investigator: Stephanie Gardiner-Walsh

2.Describe specifically how subjects will be recruited and who will be recruiting them. Please state mechanism you will use as well as location and make sure to attach your oral script and/or recruitment tools. The main source of recruitment will be distribution of flyers through publically accessible forums and groups, specifically through public forums for parents of children with hearing loss.

3.Describe how and where subjects will be recruited.

Data collection cannot begin at a site until a letter of support is received by IRB. Recruitment of participants from a UNCG class may require a letter from an instructor or department chair unaffiliated with the research project, but does NOT need to be submitted to the IRB, and may be kept on file with the researcher.

Research conducted in collaboration with other institutions requires a copy of their IRB approval notification(s). If working with Cone Health you should not have to submit to their IRB. Please view the contract for details.

Subjects will be recruited through online flyer distribution and distribution through public list services such as those supported by public libraries, announcement boards, waiting rooms, and parent support groups.

4.Have you received site approval from the location you plan to recruit from?

Yes

Please upload the site approval as an attachment at the end of your application.

Attachments

This submission requires the following attachments

Document Type

Electronic Questionnaire Survey

Flyer for Recruitment

Email or Listserv Recruitment

This submission includes the following attachments

File Name	Document Type
Oral Recruitment Prompt.docx	Email or Listserv Recruitment
Flyer for Distribution with tear aways.docx	Flyer for Recruitment
Flyer for Distribution.docx	Flyer for Recruitment
NEW_Flyer for Distribution.docx	Flyer for Recruitment
NEW_card for distribution.docx	

Flyer for Recruitment

New_Flyer for Distribution with tear aways.docx
Flyer for Recruitment

card for distribution.docx
Flyer for Recruitment

card for distribution.docx
Flyer for Recruitment

Consent to Participate.docx
Sponsor's Model Consent Form

Consent to Participate.docx
Sponsor's Model Consent Form

Dissertation_Questions.docx
Electronic Questionnaire Survey

CITI Training Cert SJGW.pdf
Other

MVCIRBcertif.pdf
Other

view attachments

Addenda

Data Security Requirements

view addenda

IRB Number: 14-0046 Modification Principal Investigator: Stephanie Gardiner-Walsh

By certifying below, the Principal Investigator affirms the following:

I will personally conduct or supervise this research study. I will ensure that this study is performed in compliance with all applicable laws, regulations and University policies regarding human subjects research. I will obtain IRB approval before making any changes or additions to the project. I will notify the IRB of any other changes in the information provided in this application. I will provide progress reports to the IRB at least annually, or as requested. I will report promptly to the IRB all unanticipated problems or serious adverse events involving risk to human subjects. I will follow the IRB approved consent process for all subjects. I will ensure that all collaborators, students and employees assisting in this research study are informed about these obligations. All information given in this form is accurate and complete.

This study proposes research that has been determined to include Security Level 1 data security requirements. I agree to accept responsibility for managing these risks appropriately in consultation with departmental and/or campus security personnel. The Data Security Requirements addendum can be reviewed here.

If PI is a Student or Trainee Investigator, the Faculty Advisor also certifies the following:

I accept ultimate responsibility for ensuring that this study complies with all the obligations listed above for the PI.

Certifying Signatures:

Signature: Electronic Signature Received Date: 2/13/2014 04:49:37 PM
Stephanie Gardiner-Walsh

Signature: Electronic Signature Received Date: 2/13/2014 04:56:58 PM
Mary Compton

Reference Id: 101533 Date Submitted: 02/13/2014 04:56:59 PM
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APPENDIX E

DISCRIMINANT ANALYSIS REFERENCE PAGE

measures the extent of association between the discriminant scores and the groups

Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	3.974	100.0	100.0	.894

a. First 1 canonical discriminant functions were used in the analysis.

the ratio of between-group to within-group sums of squares. Large Eigenvalues imply superior functions.

Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.201	32.083	18	.021

Large values of (near 1) indicate that group means do not seem to be different. Small values of (near 0) indicate that the group means seem to be different.

Functions at Group Centroids

Grouping	Function 1
1.00	-1.75
2.00	2.13

Unstandardized canonical discriminant functions evaluated at group means

The centroid is the mean values for the discriminant scores for a particular group.

When interpreting the discriminant analysis, several aspects must be considered:

1. The larger the eigenvalue, the more of the variance in the dependent variable is explained by that function.
2. Wilks' lambda is a measure of how well each function separates cases into groups. Smaller values of Wilks' lambda indicate greater discriminatory ability of the function
3. The canonical correlation is the measure of association between the discriminant function and the dependent variable. When there are two groups, such as in this study, the canonical correlation is the most useful measure in the table, and it is equivalent to Pearson's correlation. The square of canonical correlation coefficient is the percentage of variance explained in the dependent variable.
4. The associated chi-square statistic tests the hypothesis that the means of the functions listed are equal across groups. The small significance value indicates that the discriminant function does better than chance at separating the groups
5. Centroids help determine the 'cutting point' of the groups. The algebraic equation derived from the standardized canonical discriminate function

coefficient table will provide a value that centralizes around one of these values. This determines grouping.

Variables examined

Standardized Canonical Discriminant Function Coefficients

	Function
	1
Q14_1 PAST.-Hearing Aids(s)	1.699
Q14_2 PAST.-Amplification System	-.185
Q14_3 PAST.-Early Intervention Services	-.054
Q14_4 PAST.-Special school services	1.459
Q14_5 PAST.-Modifications in School	-1.206
Q14_ 6 PAST.-None. No services were used.	-1.073
Q14_8 PAST.-Other Services	.764
Q41_1 CURRENT.-Hearing Aids(s)	-.730
Q41_2 CURRENT.-Amplification System	.161
Q41_4 CURRENT.-Special school services	.519
Q41_5 CURRENT.-Modifications	.654
Q41_7 CURRENT.-None	1.338
Q41_8 CURRENT.-Other Services	-1.297
Q80 Follow Up Frequency	-1.041
Q39 Method of Detection	.235
Q12 Age of Detection	-.246
Q59 Etiology	.253
Q61 Present at Birth	.608

The standardized discriminant function coefficients are the discriminant function coefficients and are used as the multipliers when the variables have been standardized to a mean of 0 and a variance of 1.

The values given (Canonical function) in the above table indicate the relative importance of the independent variables in predicting the dependent (group belonging). The values allow you to compare variables measured (given on left side on table) on different scales. Coefficients with large absolute values correspond to variables with greater discriminating ability. These are used to create an algebraic-like equation which helps to determine how the groups separate.

Structure Matrix

	Function
	1
Q14_4 PAST.-Special school services	.386
Q41_4 CURRENT.-Special school services	.291
Q14_ 6 PAST.-None. No services were used.	-.249
Q41_5 CURRENT.-Modifications	.226
Q14_3 PAST.-Early Intervention Services	.203
Q41_5 CURRENT.-Modifications	.187
Q61 Present at Birth	.176
Q61 Present at Birth	-.147
Q41_2 CURRENT.-Amplification System	.105
Q14_2 PAST.-Amplification System	.088
Q39 Method of Detection	-.078
Q14_1 PAST.-Hearing Aids(s)	.075
Q14_8 PAST.-Other Services	.072
Q59 Etiology	.071
Q41_1 CURRENT.-Hearing Aids(s)	-.046
Q12 Age of Detection	-.019
Q41_8 CURRENT.-Other Services	.019
Q80 Follow Up Frequency	.000

Discriminant loadings- the structure correlations represent the simple correlations between the predictors and the discriminant function. For this study, values of 0.3 or greater were considered as "heavily loaded upon" and best used to distinguish grouping.

The structure matrix table (above) shows the correlations of each variable with each discriminant function. Because this was a two-group study, only one function appears. The correlations then serve like factor loadings by identifying the largest absolute correlations associated with each discriminant function the researcher gains insight into how to name each function.

APPENDIX F

TABLES

Table 11

Distribution of Children by Types of Hearing Loss

Grouping * Type of Hearing Loss Crosstabulation

			Mild Hearing Loss (both ears)	Unilateral Hearing Loss (Left Ear ONLY)	Unilateral Hearing Loss (Right Ear ONLY)	Mild to Moderate Hearing Loss (both ears)	High Frequency Hearing Loss (both ears)	Asymetrical-one mild	TOTAL
Grouping	1.00	Count	57	49	58	3	4	3	174
		% within Grouping	32.8%	28.2%	33.3%	1.7%	2.3%	1.7%	100.0%
		% within Type of Hearing Loss	73.1%	70.0%	77.3%	60.0%	57.1%	100.0%	
		% of Total	23.5%	20.2%	23.9%	1.2%	1.6%	1.2%	71.6%
	2.00	Count	23	22	19	2	3	0	69
		% within Grouping	31.9%	30.4%	26.1%	4.3%	4.3%	0.0%	100.0%
		% within Type of Hearing Loss	29.5%	31.4%	25.3%	40.0%	42.9%	0.0%	
		% of Total	9.1%	8.6%	7.4%	1.2%	1.2%	0.0%	28.4%
Total		Count	78	70	75	5	7	3	243
		% of Total	32.1%	28.8%	30.9%	2.1%	2.9%	1.2%	100.0%

** Six participants provided enough audiological data to confirm that they were eligible for participation, but their audiogram was incomplete and unable to distinguish between categories of hearing loss.

Table 12

Number of Repetitions by Students

Number of Grade Repetitions	Frequency	Percent
None	210	84.3%
1	33	13.3%
2	6	2.4%
Total	249	100.0%

Table 13

Case Summary Statistics for Left Ear

Grouping	Statistic	250Hz Left Ear	500Hz Left Ear	1000Hz Left Ear	2000Hz Left Ear	4000Hz Left Ear	8000Hz Left Ear
	N	158	158	158	158	158	158
	Mean	21.83	22.08	19.99	17.43	20.37	23.19
	Standard Error	1.049	1.084	1.311	1.286	1.424	1.217
	95% CI Lower Bound	19.26	19.45	16.9	14.37	17.06	22.69
	Upper Bound	23.41	23.73	22.08	19.45	22.69	25.11
1.00	Std. Deviation	14.49	14.88	17.56	17.34	18.87	16.37
	Variance	209.95	221.38	308.22	300.78	356.17	267.89
	Kurtosis	10.07	10.67	9.85	13.55	8.69	9.60
	Std. Error of Kurtosis	0.38	0.38	0.38	0.38	0.38	0.38
	Skewness	2.48	2.62	2.69	3.33	2.69	2.39
	Std. Error of Skewness	0.19	0.19	0.19	0.19	0.19	0.19
	N	54	54	54	54	54	54
	Mean	25.46	27.22	25.19	23.33	26.67	24.00
	Standard Error	2.37	2.76	2.84	3.07	2.96	3.61
	95% CI Lower Bound	20.71	21.68	19.49	17.17	20.74	16.77
	Upper Bound	30.21	32.76	30.88	29.50	32.59	31.23
2.00	Std. Deviation	17.41	20.30	20.85	22.59	21.72	26.50
	Variance	303.08	411.95	434.87	510.38	471.70	702.30
	Kurtosis	6.61	3.58	4.28	4.08	2.06	8.89
	Std. Error of Kurtosis	0.64	0.64	0.64	0.64	0.64	0.64
	Skewness	2.16	1.80	1.97	1.85	1.48	-1.13
	Std. Error of Skewness	0.33	0.33	0.33	0.33	0.33	0.33

Table 13

(Cont.)

Grouping	Statistic	250Hz Left Ear	500Hz Left Ear	1000Hz Left Ear	2000Hz Left Ear	4000Hz Left Ear	8000Hz Left Ear
	N	212	212	212	212	212	212
	Mean	22.75	23.39	21.32	18.93	21.98	23.40
	Standard Error	0.99	11.08	1.23	1.25	1.31	1.29
	95% CI Lower Bound	20.44	20.91	18.55	16.10	19.03	23.94
	Upper Bound	24.34	25.15	23.35	21.00	24.19	25.57
Total	Std. Deviation	15.33	16.53	18.54	18.94	19.78	19.39
	Variance	234.87	273.24	343.72	358.65	391.06	375.86
	Kurtosis	8.70	7.60	7.56	9.21	5.92	11.28
	Std. Error of Kurtosis	0.33	0.33	0.33	0.33	0.33	0.33
	Skewness	2.38	2.35	2.44	2.77	2.27	0.39
	Std. Error of Skewness	0.17	0.17	0.17	0.17	0.17	0.17

Table 14

Independent *t*-Test, Left Ear Audiogram

Independent Samples Test

		Levene's Test		t-test for Equality of Means						95% CI of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Effect Size r	Lower	Upper
Left Ear dB@250Hz	Equal variances assumed	3.28	0.072	**-1.82**	**209**	**0.07**	**-4.13**	**2.26**	**0.13**	**-8.59**	**0.34**
	not assumed			-1.59	74.86	0.116	-4.13	2.59	0.18	-9.29	1.04
Left Ear dB@500Hz	Equal variances assumed	8.15	0.005	-2.29	209	0.023	-5.63	2.46	0.16	-10.47	-0.79
	not assumed			**-1.90**	**70.03**	**0.062**	**-5.63**	**2.97**	**0.22**	**-11.55**	**0.29**
Left Ear dB@1000Hz	Equal variances assumed	2.89	0.09	**-2.04**	**209**	**0.042**	**-5.70**	**2.79**	**0.14**	**-11.19**	**-0.20**
	not assumed			-1.82	76.86	0.072	-5.70	3.13	0.20	-11.92	0.53
Left Ear dB@2000Hz	Equal variances assumed	8.33	0.004	-2.26	209	0.025	-6.42	2.84	0.16	-12.02	-0.83
	not assumed			**-1.93**	**72.43**	**0.058**	**-6.42**	**3.33**	**0.22**	**-13.07**	**0.22**
Left Ear dB@4000Hz	Equal variances assumed	5.70	0.018	-2.28	209	0.024	-6.79	2.98	0.16	-12.67	-0.91
	not assumed			**-2.07**	**79.03**	**0.042**	**-6.79**	**3.28**	**0.23**	**-13.32**	**-0.26**
Left Ear dB@8000Hz	Equal variances assumed	8.73	0.003	-0.44	209	0.663	-1.29	2.96	0.03	-7.13	4.54
	not assumed			**-0.34**	**65.47**	**0.735**	**-1.29**	**3.81**	**0.04**	**-8.89**	**6.31**

Table 15

Case Summary Frequency of Right Ear

Grouping	Statistic	250Hz Right Ear	500Hz Right Ear	1000Hz Right Ear	2000Hz Right Ear	4000Hz Right Ear	8000Hz Right Ear
	N	158	158	158	158	158	158
	Mean	23.51	23.45	19.43	17.50	20.25	25.41
	Std. Deviation	14.18	14.43	14.81	16.97	17.57	18.15
	Standard Error	1.33	1.15	1.19	1.36	1.41	1.45
	95% CI Lower Bound	21.20	21.10	17.08	14.83	17.41	22.58
1.00	Upper Bound	25.68	25.65	21.77	20.20	22.97	28.31
	Variance	201.12	208.25	219.42	287.82	308.85	329.29
	Kurtosis	6.34	8.21	9.62	9.14	6.69	6.00
	Std. Error of Kurtosis	0.38	0.38	0.38	0.38	0.38	0.38
	Skewness	2.03	2.30	2.62	2.79	2.30	2.15
	Std. Error of Skewness	0.19	0.19	0.19	0.19	0.19	0.19
	N	54	54	54	54	54	54
	Mean	25.19	26.57	22.78	21.57	24.26	24.54
	Standard Error	2.13	2.54	2.31	2.47	2.52	2.14
	95% CI Lower Bound	20.91	21.48	18.15	16.63	19.20	20.25
	Upper Bound	29.46	31.67	27.41	26.52	29.32	28.82
2.00	Std. Deviation	15.66	18.65	16.95	18.12	18.54	15.70
	Variance	245.25	347.95	287.42	328.14	343.78	246.48
	Kurtosis	4.64	3.48	1.52	2.15	2.59	1.58
	Std. Error of Kurtosis	0.64	0.64	0.64	0.64	0.64	0.64
	Skewness	1.52	1.67	1.27	1.48	1.46	0.87
	Std. Error of Skewness	0.33	0.33	0.33	0.33	0.33	0.33

Table 15

(Cont.)

Grouping	Statistic	250Hz Right Ear	500Hz Right Ear	1000Hz Right Ear	2000Hz Right Ear	4000Hz Right Ear	8000Hz Right Ear
Total	N	212	212	212	212	212	212
	Mean	23.94	24.25	20.28	18.54	21.27	25.19
	Standard Error	1.00	1.07	1.06	1.19	1.23	1.20
	95% CI Lower Bound	21.98	25.15	18.21	16.21	18.86	22.83
	Upper Bound	25.90	26.35	23.35	20.87	23.68	27.55
	Std. Deviation	14.55	15.63	15.41	17.31	17.87	17.52
	Variance	211.78	244.21	237.60	299.75	319.22	307.07
	Kurtosis	5.64	6.32	6.45	6.61	5.18	5.41
	Std. Error of Kurtosis	0.33	0.33	0.33	0.33	0.33	0.33
	Skewness	1.87	2.10	2.17	2.38	2.03	1.93
	Std. Error of Skewness	0.17	0.17	0.17	0.17	0.17	0.17

Table 16

Independent *t*-Test, Right Ear Audiogram

		Levene's Test		t-test for Equality of Means							
		F	Sig.	t	df	Sig. (2 tailed)	Mean Difference	Std. Error Difference	Effect Size r	95% CI of the Difference Lower	95% CI of the Difference Upper
Right Ear dB@250Hz	Equal variances assumed	0.54	0.464	**-0.73**	**210**	**0.467**	**-1.67**	**2.30**	**0.05**	**-6.20**	**2.86**
	not assumed			-0.69	84.63	0.490	-1.67	2.41	0.08	-6.47	3.12
Right Ear dB@500Hz	Equal variances assumed	3.58	0.060	**-1.27**	**210**	**0.205**	**-3.13**	**2.46**	**0.09**	**-7.97**	**1.72**
	not assumed			-1.12	75.83	0.266	-3.13	2.79	0.13	-8.67	2.42
Right Ear dB@1000Hz	Equal variances assumed	3.43	0.065	**-1.38**	**210**	**0.169**	**-3.35**	**2.43**	**0.10**	**-8.13**	**1.43**
	not assumed			-1.29	82.37	0.200	-3.35	2.59	0.14	-8.50	1.81
Right Ear dB@2000Hz	Equal variances assumed	1.76	0.186	**-1.50**	**210**	**0.136**	**-4.07**	**2.72**	**0.10**	**-9.44**	**1.29**
	not assumed			-1.45	86.90	0.151	-4.07	2.81	0.15	-9.66	1.51
Right Ear dB@4000Hz	Equal variances assumed	0.94	0.333	**-1.43**	**210**	**0.155**	**-4.01**	**2.81**	**0.10**	**-9.55**	**1.53**
	not assumed			-1.39	87.75	0.168	-4.01	2.89	0.15	-9.74	1.73
Right Ear dB@8000Hz	Equal variances assumed	0.15	0.699	**0.32**	**210**	**0.752**	**0.87**	**2.77**	**0.02**	**-4.58**	**6.33**
	not assumed			0.34	105.06	0.735	0.87	2.58	0.03	-4.24	5.99

Table 17

Case Summary of PTA and AI

Grouping	Statistics	L_AI Articulation Index Left Ear	R_AI Articulation Index Right Ear	L_PTA Left Ear Pure Tone Average	R_PTA Right Ear Pure Tone Average
	N	158	158	158	158
	Mean	85.68	84.18	19.97	20.16
	Standard Error	1.75	1.92	0.85	1.13
	95% CI Lower Bound	82.13	80.44	18.13	17.89
	Upper Bound	89.06	88.01	21.47	22.37
1.00	Std. Deviation	21.93	23.94	15.84	14.16
	Variance	480.80	573.29	250.89	200.45
	Kurtosis	6.20	5.06	13.75	11.58
	Std. Error of Kurtosis	0.38	0.38	0.38	0.38
	Skewness	-2.47	-2.39	3.32	3.03
	Std. Error of Skewness	0.19	0.19	0.19	0.19
	N	54	54	54	54
	Mean	73.13	75.26	25.60	23.80
	Standard Error	4.27	2.26	1.93	2.29
	95% CI Lower Bound	64.57	66.72	20.83	19.21
	Upper Bound	81.69	83.30	28.58	28.28
2.00	Std. Deviation	31.35	31.28	19.72	16.79
	Variance	982.53	978.69	388.96	281.90
	Kurtosis	0.18	0.75	5.06	2.94
	Std. Error of Kurtosis	0.64	0.64	0.64	0.64
	Skewness	-1.23	-1.43	2.09	1.62
	Std. Error of Skewness	0.33	0.33	0.33	0.33

Table 17

(Cont.)

	Grouping Statistics	L_AI Articulation Index Left Ear	R_AI Articulation Index Right Ear	L_PTA Left Ear Pure Tone Average	R_PTA Right Ear Pure Tone Average
	N	212	212	212	212
	Mean	82.49	81.91	21.40	21.08
	Standard Error	1.74	1.80	1.12	1.02
	95% CI Lower Bound	79.00	78.38	18.85	21.09
	Upper Bound	85.80	85.44	23.22	23.09
Total	Std. Deviation	25.19	26.22	17.04	14.92
	Variance	634.61	687.59	290.43	222.48
	Kurtosis	3.37	3.26	9.88	7.99
	Std. Error of Kurtosis	0.33	0.33	0.33	0.33
	Skewness	-2.02	-2.06	2.86	2.53
	Std. Error of Skewness	0.17	0.17	0.17	0.17

Table 18

Independent *t*-Test, AI and PTA

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means							
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Effect Size	95% Confidence Interval of the Difference	
									r	Lower	Upper
L_AI Articulation Index Left Ear	Equal variances assumed	14.13	0.000	3.20	209.00	0.002	12.46	3.89	0.22	4.79	20.14
	not assumed			**2.70**	**71.72**	**0.009**	**12.46**	**4.61**	**0.30**	**3.27**	**21.66**
R_AI Articulation Index Right Ear	Equal variances assumed	9.46	0.002	2.18	210.00	0.031	8.92	4.10	0.15	0.85	17.00
	not assumed			**1.91**	**75.33**	**0.059**	**8.92**	**4.66**	**0.22**	**-0.37**	**18.21**
L_PTA Left Ear Pure Tone Average	Equal variances assumed	5.25	0.023	-2.43	209.00	0.016	-6.14	2.53	0.17	-11.12	-1.15
	not assumed			**-2.10**	**73.87**	**0.039**	**-6.14**	**2.93**	**0.24**	**-11.96**	**-0.31**
R_PTA Right Ear Pure Tone Average	Equal variances assumed	3.80	0.053	-1.55	210.00	0.122	-3.64	2.34	0.11	-8.26	0.98
	not assumed			**-1.43**	**80.29**	**0.157**	**-3.64**	**2.55**	**0.16**	**-8.71**	**1.43**

Table 19

Discriminant Analysis of Audiological Factors

Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	.108[a]	100.0	100.0	.312

[a] First 1 canonical discriminant functions were used in the analysis.

Wilks's Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.903	20.784	14	.107

Functions at Group Centroids

Grouping	Function
	1
1.00	.19
2.00	-.56

Unstandardized canonical discriminant functions evaluated at group means

Table 19

(Cont.)

Standardized Canonical Discriminant Function Coefficients

	Function
	1
L250 Left Ear dB@250Hz	0.08
L500 Left Ear dB@500Hz	-0.17
L1000 Left Ear dB@1000Hz	0.41
L2000 Left Ear dB@2000Hz	0.06
L4000 Left Ear dB@4000Hz	0.09
L8000 Left Ear dB@8000Hz	0.09
R250 Right Ear dB@250Hz	1.43
R500 Right Ear dB@500Hz	-1.21
R1000 Right Ear dB@1000Hz	0.27
R2000 Right Ear dB@2000Hz	0.07
R4000 Right Ear dB@4000Hz	0.17
R8000 Right Ear dB@8000Hz	0.39
L_AI Articulation Index Left Ear	0.95
R_AI Articulation Index Right Ear	1.21

Table 19

(Cont.)

Structure Matrix

	Function
	1
L_AI Articulation Index Left Ear	0.68
R_AI Articulation Index Right Ear	0.46
L4000 Left Ear dB@4000Hz	-0.43
L2000 Left Ear dB@2000Hz	-0.42
L500 Left Ear dB@500Hz	-0.42
L1000 Left Ear dB@1000Hz	-0.38
L250 Left Ear dB@250Hz	-0.32
R2000 Right Ear dB@2000Hz	-0.32
R4000 Right Ear dB@4000Hz	-0.30
R1000 Right Ear dB@1000Hz	-0.29
R500 Right Ear dB@500Hz	-0.27
R250 Right Ear dB@250Hz	-0.15
R8000 Right Ear dB@8000Hz	0.07
L8000 Left Ear dB@8000Hz	-0.06

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions
Variables ordered by absolute size of correlation within function.

Table 20

Crosstabulation and Chi-square, Past and Present Hearing Aid Usage

HEARING AIDS		PAST		PRESENT		Total
		0 No	1 Yes	0 No	1 Yes	
1.00	Count	166	13	166	13	179
	% within Grouping	92.7%	7.3%	92.7%	7.3%	100.0%
	% within Q14_1 PAST/ PRESENT.-Hearing Aids(s)	76.5%	40.6%	74.4%	50.0%	71.9%
	% of Total	66.7%	5.2%	66.7%	5.2%	71.9%
2.00	Count	51	19	57	13	70
	% within Grouping	72.9%	27.1%	81.4%	18.6%	100.0%
	% within Q14_1 PAST /PRESENT.-Hearing Aids	23.5%	59.4%	25.6%	50.0%	28.1%
	% of Total	20.5%	7.6%	22.9%	5.2%	28.1%
Total	Count	217	32	223	26	249
	% of Total	87.1%	12.9%	89.6%	10.4%	100.0%

Table 20

(Cont.)

Chi-square Tests

PAST.-Hearing Aids(s)	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-square	17.76[a]	1	.000		
Continuity Correction[b]	16.03	1	.000		
Likelihood Ratio	15.94	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	17.69	1	.000		
N of Valid Cases	249				

[a] 0 cells (0.0%) have expected count less than 5. The minimum expected count is 9.00.

[b] Computed only for a 2x2 table

CURRENT.-Hearing Aids(s)	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-square	6.88[a]	1	.009		
Continuity Correction[b]	5.73	1	.017		
Likelihood Ratio	6.26	1	.012		
Fisher's Exact Test				.019	.010
Linear-by-Linear Association	6.85	1	.009		
N of Valid Cases	249				

[a] 0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.31.

[b] Computed only for a 2x2 table

Table 21

Crosstab and Chi-square, Past and Present Classroom Amplification

AMPLIFICATION SYSTEM		PAST 0 No	PAST 1 Yes	PRESENT 0 No	PRESENT 1 Yes	Total
1.00	Count	167	12	172	7	179
	% within Grouping	93.3%	6.7%	96.1%	3.9%	100.0%
	% within Q14_2 PAST/ PRESENT.-Amplification System	75.9%	41.4%	74.1%	41.2%	71.9%
	% of Total	67.1%	4.8%	69.1%	2.8%	71.9%
2.00	Count	53	17	60	10	70
	% within Grouping	75.7%	24.3%	85.7%	14.3%	100.0%
	% within Q14_2 PAST/ PRESENT.-Amplification System	24.1%	58.6%	25.9%	58.8%	28.1%
	% of Total	21.3%	6.8%	24.1%	4.0%	28.1%
Total	Count	220	29	232	17	249
	% of Total	88.4%	11.6%	93.2%	6.8%	100.0%

Table 21

(Cont.)

Chi-square Tests

PAST.-Amplification System (FM system, speakers in classroom)	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-square	15.12[a]	1	.000		
Continuity Correction[b]	13.46	1	.000		
Likelihood Ratio	13.55	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	15.06	1	.000		
N of Valid Cases	249				

[a] 0 cells (0.0%) have expected count less than 5. The minimum expected count is 8.15.

[b] Computed only for a 2x2 table

Chi-square Tests

CURRENT.-Amplification System (FM system, speakers in classroom)	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-square	8.52[a]	1	.004		
Continuity Correction[b]	6.96	1	.008		
Likelihood Ratio	7.56	1	.006		
Fisher's Exact Test				.009	.006
Linear-by-Linear Association	8.48	1	.004		
N of Valid Cases	249				

[a] 1 cells (25.0%) have expected count less than 5. The minimum expected count is 4.78.

[b] Computed only for a 2x2 table

Table 22

Crosstab and Chi-square, Past Early Intervention Services

EARLY INTERVENTION		PAST 0 No	PAST 1 Yes	Total
1.00	Count	172	7	179
	% within Grouping	96.1%	3.9%	100.0%
	% within 3 PAST.-Early Intervention Services	74.8%	36.8%	71.9%
	% of Total	69.1%	2.8%	71.9%
2.00	Count	58	12	70
	% within Grouping	82.9%	17.1%	100.0%
	% within 3 PAST.-Early Intervention Services	25.2%	63.2%	28.1%
	% of Total	23.3%	4.8%	28.1%
Total	Count	230	19	249
	% of Total	92.4%	7.6%	100.0%

Chi-square Tests

PAST.-Early Intervention Services	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-square	12.50[a]	1	.000		
Continuity Correction[b]	10.69	1	.001		
Likelihood Ratio	11.04	1	.001		
Fisher's Exact Test				.001	.001
Linear-by-Linear Association	12.45	1	.000		
N of Valid Cases	249				

[a] 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.34.

[b] Computed only for a 2x2 table

Table 23

Crosstab and Chi-square, Past and Present Specialized School Services

SPECIAL SCHOOL SERVICES			PAST 0 No	PAST 1 Yes	PRESENT 0 No	PRESENT 1 Yes	Total
1.00		Count	174	5	175	4	179
		% within Grouping	97.2%	2.8%	97.8%	2.2%	100.0%
		% within Q14_4 PAST/ PRESENT.-Special school services	77.7%	20.0%	75.1%	25.0%	71.9%
		% of Total	69.9%	2.0%	70.3%	1.6%	71.9%
2.00		Count	50	20	58	12	70
		% within Grouping	71.4%	28.6%	82.9%	17.1%	100.0%
		% within Q14_4 PAST/ PRESENT.-Special school services	22.3%	80.0%	24.9%	75.0%	28.1%
		% of Total	20.1%	8.0%	23.3%	4.8%	28.1%
Total		Count	224	25	233	16	249
		% of Total	90.0%	10.0%	93.6%	6.4%	100.0%

Chi-square Tests

PAST.-Special school services	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-square	37.02[a]	1	.000		
Continuity Correction[b]	34.22	1	.000		
Likelihood Ratio	32.93	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	36.87	1	.000		
N of Valid Cases	249				

[a] 0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.03.
[b] Computed only for a 2x2 table

Table 23

(Cont.)

Chi-square Tests

CURRENT.-Special school services	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-square	18.60[a]	1	.000		
Continuity Correction[b]	16.20	1	.000		
Likelihood Ratio	16.33	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	18.53	1	.000		
N of Valid Cases	249				

[a] 1 cells (25.0%) have expected count less than 5. The minimum expected count is 4.50.
[b] Computed only for a 2x2 table

Table 24

Crosstab and Chi-square, Past and Present School Setting Modifications

MODIFICATION TO SCHOOL SETTING		PAST		PRESENT		Total
		0 No	1 Yes	0 No	1 Yes	
1.00	Count	168	11	169	10	179
	% within Grouping	93.9%	6.1%	94.4%	5.6%	100.0%
	% within PAST/ PRESENT-Modifications in School	76.4%	37.9%	74.8%	43.5%	71.9%
	% of Total	67.5%	4.4%	67.9%	4.0%	71.9%
2.00	Count	52	18	57	13	70
	% within Grouping	74.3%	25.7%	81.4%	18.6%	100.0%
	% within PAST/ PRESENT-Modifications in School	23.6%	62.1%	25.2%	56.5%	28.1%
	% of Total	20.9%	7.2%	22.9%	5.2%	28.1%
Total	Count	220	29	226	23	249
	% of Total	88.4%	11.6%	90.8%	9.2%	100.0%

Chi-square Tests

PAST.-Modifications in School	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-square	18.73[a]	1	.000		
Continuity Correction[b]	16.87	1	.000		
Likelihood Ratio	16.71	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	18.65	1	.000		
N of Valid Cases	249				

[a] 0 cells (0.0%) have expected count less than 5. The minimum expected count is 8.15.
[b] Computed only for a 2x2 table

CURRENT.-Modifications in School	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-square	10.12[a]	1	.001		
Continuity Correction[b]	8.63	1	.003		
Likelihood Ratio	9.06	1	.003		
Fisher's Exact Test				.003	.003
Linear-by-Linear Association	10.08	1	.001		
N of Valid Cases	249				

[a] 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.47.
[b] Computed only for a 2x2 table

Table 25

Crosstab and Chi-square, Past and Present 'No Services Used'

SERVICES USED		PAST Used Services	PAST No Services	PRESENT Used Services	PRESENT No Services	Total
1.00	Count	169	10	170	9	179
	% within Grouping	94.4%	5.6%	95.0%	5.0%	100.0%
	% within PAST/PRESENT-Services	70.7%	100.0%	71.1%	90.0%	71.9%
	% of Total	67.9%	4.0%	68.3%	3.6%	71.9%
2.00	Count	70	0	69	1	70
	% within Grouping	100.0%	0.0%	98.6%	1.4%	100.0%
	% within PAST/PRESENT-Services	29.3%	0.0%	28.9%	10.0%	28.1%
	% of Total	28.1%	0.0%	27.7%	.4%	28.1%
Total	Count	239	10	239	10	249
	% of Total	96.0%	4.0%	96.0%	4.0%	100.0%

Chi-square Tests

PAST.-None. No services were used.	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-square	4.07[a]	1	.044		
Continuity Correction[b]	2.75	1	.097		
Likelihood Ratio	6.76	1	.009		
Fisher's Exact Test				.066	.034
Linear-by-Linear Association	4.06	1	.044		
N of Valid Cases	249				

[a] 1 cells (25.0%) have expected count less than 5. The minimum expected count is 2.81.

[b] Computed only for a 2x2 table

CURRENT.-None	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-square	1.69[a]	1	.193		
Continuity Correction[b]	.89	1	.346		
Likelihood Ratio	2.05	1	.153		
Fisher's Exact Test				.291	.175
Linear-by-Linear Association	1.68	1	.194		
N of Valid Cases	249				

[a] 1 cells (25.0%) have expected count less than 5. The minimum expected count is 2.81.

[b] Computed only for a 2x2 table

Table 26

Crosstab and Chi-square, Past and Present Other Services Used

OTHER SERVICES USED		PAST		PRESENT		Total
		No Other Services	Used Services	No Other Services	Used Services	
1.00	Count	34	1	33	2	35
	% within Grouping	97.1%	2.9%	94.3%	5.7%	100.0%
	% within PAST/PRESENT-Services	56.7%	33.3%	55.9%	50.0%	55.6%
	% of Total	54.0%	1.6%	52.4%	3.2%	55.6%
2.00	Count	26	2	26	2	28
	% within Grouping	92.9%	7.1%	92.9%	7.1%	100.0%
	% within PAST/PRESENT-Services	43.3%	66.7%	44.1%	50.0%	44.4%
	% of Total	41.3%	3.2%	41.3%	3.2%	44.4%
Total	Count	60	3	59	4	63
	% of Total	95.2%	4.8%	93.7%	6.3%	100.0%

i-Square Tests

PAST.-Other Services Used	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-square	.603	1	.427		
Continuity Correction[b]	.039	1	.843		
Likelihood Ratio	.630	1	.427		
Fisher's Exact Test				.580	.416
Linear-by-Linear Association	.620	1	.431		
N of Valid Cases	63				

[a] 1 cells (25.0%) have expected count less than 5. The minimum expected count is 2.81.

[b] Computed only for a 2x2 table

CURRENT-Other Services Used	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-square	.053[a]	1	.817		
Continuity Correction[b]	.000	1	1.000		
Likelihood Ratio	.053	1	.818		
Fisher's Exact Test				1.000	.604
Linear-by-Linear Association	.053	1	.819		
N of Valid Cases	63				

[a] 1 cells (25.0%) have expected count less than 5. The minimum expected count is 2.81.

b. Computed only for a 2x2 table

Table 27

Crosstab and Chi-square Follow-up Frequency

			Grouping 1.00	Grouping 2.00	Total
Q80 Follow Up Frequency	1 More than once a year	Count	8	11	19
		% within Q80 Follow Up Frequency	42.1%	57.9%	100.0%
		% within Grouping	34.8%	55.0%	44.2%
		% of Total	18.6%	25.6%	44.2%
	2 Once a year	Count	9	4	13
		% within Q80 Follow Up Frequency	69.2%	30.8%	100.0%
		% within Grouping	39.1%	20.0%	30.2%
		% of Total	20.9%	9.3%	30.2%
	3 Every other year	Count	4	4	8
		% within Q80 Follow Up Frequency	50.0%	50.0%	100.0%
		% within Grouping	17.4%	20.0%	18.6%
		% of Total	9.3%	9.3%	18.6%
	4 Very rarely	Count	2	0	2
		% within Q80 Follow Up Frequency	100.0%	0.0%	100.0%
		% within Grouping	8.7%	0.0%	4.7%
		% of Total	4.7%	0.0%	4.7%
	5 Never	Count	0	1	1
		% within Q80 Follow Up Frequency	0.0%	100.0%	100.0%
		% within Grouping	0.0%	5.0%	2.3%
		% of Total	0.0%	2.3%	2.3%
Total		Count	23	20	43
		% of Total	53.5%	46.5%	100.0%

Chi-square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	5.21[a]	4	.266
Likelihood Ratio	6.40	4	.171
Linear-by-Linear Association	.41	1	.521
N of Valid Cases	43		

a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is .47.

Table 28

Discriminant Analysis for Services and Interventions

Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	3.974	100.0	100.0	.894

a. First 1 canonical discriminant functions were used in the analysis.

Wilks's Lambda

Test of Function(s)	Wilks's Lambda	Chi-square	df	Sig.
1	.201	32.083	18	.021

Functions at Group Centroids

Grouping	Function
	1
1.00	-1.75
2.00	2.13

Unstandardized canonical discriminant functions evaluated at group means

Table 28

(Cont.)

Standardized Canonical Discriminant Function Coefficients

	Function 1
Q14_1 PAST.-Hearing Aids(s)	1.699
Q14_2 PAST.-Amplification System	-.185
Q14_3 PAST.-Early Intervention Services	-.054
Q14_4 PAST.-Special school services	1.459
Q14_5 PAST.-Modifications in School	-1.206
Q14_ 6 PAST.-None. No services were used.	-1.073
Q14_8 PAST.-Other Services	.764
Q41_1 CURRENT.-Hearing Aids(s)	-.730
Q41_2 CURRENT.-Amplification System	.161
Q41_4 CURRENT.-Special school services	.519
Q41_5 CURRENT.-Modifications	.654
Q41_7 CURRENT.-None	1.338
Q41_8 CURRENT.-Other Services	-1.297
Q80 Follow Up Frequency	-1.041
Q39 Method of Detection	.235
Q12 Age of Detection	-.246
Q59 Etiology	.253
Q61 Present at Birth	.608

Table 28

(Cont.)

Structure Matrix

	Function 1
Q14_4 PAST.-Special school services	.386
Q41_4 CURRENT.-Special school services	.291
Q14_ 6 PAST.-None. No services were used.	-.249
Q41_5 CURRENT.-Modifications	.226
Q14_3 PAST.-Early Intervention Services	.203
Q41_5 CURRENT.-Modifications	.187
Q61 Present at Birth	.176
Q61 Present at Birth	-.147
Q41_2 CURRENT.-Amplification System	.105
Q14_2 PAST.-Amplification System	.088
Q39 Method of Detection	-.078
Q14_1 PAST.-Hearing Aids(s)	.075
Q14_8 PAST.-Other Services	.072
Q59 Etiology	.071
Q41_1 CURRENT.-Hearing Aids(s)	-.046
Q12 Age of Detection	-.019
Q41_8 CURRENT.-Other Services	.019
Q80 Follow Up Frequency	.000

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions
Variables ordered by absolute size of correlation within function.

Table 29

Crosstabulation of Age of Detection by Group

			Age of Detection									
			Birth-6 months	6 to 12 months	1 year old	2 years old	3 years old	4 years old	5 years old	6 years old	7 years or older	Total
Grouping	1.00	Count	7	1	5	1	2	3	4	0	6	29
		% within Grouping	24.1%	3.4%	17.2%	3.4%	6.9%	10.3%	13.8%	0.0%	20.7%	100.0%
		% within Age of Detection	50.0%	100.0%	71.4%	25.0%	50.0%	75.0%	44.4%	0.0%	60.0%	51.8%
		% of Total	12.5%	1.8%	8.9%	1.8%	3.6%	5.4%	7.1%	0.0%	10.7%	51.8%
	2.00	Count	7	0	2	3	2	1	5	3	4	27
		% within Grouping	25.9%	0.0%	7.4%	11.1%	7.4%	3.7%	18.5%	11.1%	14.8%	100.0%
		% within Age of Detection	50.0%	0.0%	28.6%	75.0%	50.0%	25.0%	55.6%	100.0%	40.0%	48.2%
		% of Total	12.5%	0.0%	3.6%	5.4%	3.6%	1.8%	8.9%	5.4%	7.1%	48.2%
Total		Count	14	1	7	4	4	4	9	3	10	56
		% of Total	25.0%	1.8%	12.5%	7.1%	7.1%	7.1%	16.1%	5.4%	17.9%	100.0%

Table 30

Chi-square Test of Age of Detection

Chi-square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	7.74[a]	8	.460
Likelihood Ratio	9.41	8	.309
Linear-by-Linear Association	.24	1	.624
N of Valid Cases	56		

Table 31

Skew and Kurtosis of Age of Identification

Descriptive

	Grouping		Statistic	Std. Error
Age of Identification	1.00	Skewness	-0.01	0.43
		Kurtosis	-1.68	0.85
	2.00	Skewness	-0.38	0.45
		Kurtosis	-1.49	0.87

Table 32

Crosstabulation and Chi-square Newborn Hearing Screening

Present at Birth Crosstabulation (via Newborn Hearing Screening)

			Present at Birth			
			Yes	No, it was acquired	Unknown	Total
Grouping	1.00	Count	5	12	5	22
		% within Grouping	22.7%	54.5%	22.7%	100.0%
		% within Present at Birth	55.6%	60.0%	35.7%	51.2%
		% of Total	11.6%	27.9%	11.6%	51.2%
	2.00	Count	4	8	9	21
		% within Grouping	19.0%	38.1%	42.9%	100.0%
		% within Present at Birth	44.4%	40.0%	64.3%	48.8%
		% of Total	9.3%	18.6%	20.9%	48.8%
Total		Count	9	20	14	43
		% of Total	20.9%	46.5%	32.6%	100.0%

Chi-square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	2.03[a]	2	.362
Likelihood Ratio	2.05	2	.358
Linear-by-Linear Association	1.14	1	.285
N of Valid Cases	43		

[a] 2 cells (33.3%) have expected count less than 5. The minimum expected count is 4.40.

Table 33

Crosstabulation and Chi-square for Method of Detection

Method of Detection Crosstabulation

			Method of Detection					
			Unknown	Newborn Hearing Screening	Parent/Family member concern	Doctor Concern	School Referral	Total
Grouping	1.00	Count	1	6	16	4	3	30
		% within Grouping	3.3%	20.0%	53.3%	13.3%	10.0%	100.0%
		% within Method of Detection	100.0%	46.2%	55.2%	80.0%	33.3%	52.6%
		% of Total	1.8%	10.5%	28.1%	7.0%	5.3%	52.6%
	2.00	Count	0	7	13	1	6	27
		% within Grouping	0.0%	25.9%	48.1%	3.7%	22.2%	100.0%
		% within Method of Detection	0.0%	53.8%	44.8%	20.0%	66.7%	47.4%
		% of Total	0.0%	12.3%	22.8%	1.8%	10.5%	47.4%
Total		Count	1	13	29	5	9	57
		% of Total	1.8%	22.8%	50.9%	8.8%	15.8%	100.0%

Chi-square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	4.04[a]	4	.401
Likelihood Ratio	4.56	4	.335
Linear-by-Linear Association	.34	1	.561
N of Valid Cases	57		

[a] 6 cells (60.0%) have expected count less than 5. The minimum expected count is .47.

Table 34

Crosstabulation and Chi-square for Etiology of Hearing Loss

Crosstab

			Etiology							
			Unknown	Birth Trauma, Rh factor, Pre-maturity	Illness (measles, mumps, rubella, high fever, etc.)	Chronic Infection	Genetic/ Inherited	Other	Injury/ Damage	Total
Grouping	1.00	Count	135	2	7	10	4	5	11	174
		% within Grouping	77.6%	1.1%	4.0%	5.7%	2.3%	2.9%	6.3%	100.0%
		% within Etiology	76.7%	66.7%	63.6%	66.7%	30.8%	83.3%	61.1%	71.6%
		% of Total	55.6%	.8%	2.9%	4.1%	1.6%	2.1%	4.5%	71.6%
	2.00	Count	42	1	4	5	9	1	7	69
		% within Grouping	60.9%	1.4%	5.8%	7.2%	13.0%	1.4%	10.1%	100.0%
		% within Etiology	23.9%	33.3%	36.4%	33.3%	69.2%	16.7%	38.9%	28.4%
		% of Total	17.3%	.4%	1.6%	2.1%	3.7%	.4%	2.9%	28.4%
Total		Count	176	3	11	15	13	6	18	243
		% of Total	72.4%	1.2%	4.5%	6.2%	5.3%	2.5%	7.4%	100.0%

Table 34

(Cont.)

Chi-square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	14.78[a]	7	.039
Likelihood Ratio	13.7	7	.057
Linear-by-Linear Association	5.07	1	.024
N of Valid Cases	243		

[a] 9 cells (56.3%) have expected count less than 5. The minimum expected count is .28.

Table 35

Mean Scores on SIFTER by Category, Color Coded by Score Rating

Group Statistics

	Grouping	*N*	*M*	*SD*	SE Mean
Academics	1.00	29	10.45	4.64	.86
	2.00	35	9.06	3.43	.58
Attention	1.00	29	5.97	4.28	.79
	2.00	35	8.23	4.15	.70
Communication	1.00	29	10.24	3.27	.61
	2.00	35	8.51	2.86	.48
Participation	1.00	29	8.48	3.17	.59
	2.00	35	9.31	3.21	.54
Behavior	1.00	29	7.45	3.46	.64
	2.00	35	9.63	3.47	.59
Self Advocacy	1.00	28	3.54	1.95	.37
	2.00	22	3.77	2.74	.58
SIFTER TOTAL	1.00	29	42.59	12.42	2.30
	2.00	35	44.74	13.07	2.21
SIFTERPLUS	1.00	29	46.00	13.75	2.55
	2.00	35	47.1143	13.48152	2.27879

Scores within the “FAIL” range
Scores within the “MARGINAL” ranges
Scores within the “PASS” range

Table 36

Skew and Kurtosis of SIFTER Scores

		Group1 Statistic	SE	Group 2 Statistic	SE
Academics	Skew	-0.61	0.43	-0.17	0.40
	Kurtosis	-1.24	0.85	-1.00	0.78
Attention	Skew	1.11	0.43	-0.12	0.40
	Kurtosis	0.20	0.85	-1.46	0.78
Communication	Skew	-0.44	0.43	0.32	0.40
	Kurtosis	-0.73	0.85	-0.34	0.78
Participation	Skew	-0.75	0.43	-0.35	0.40
	Kurtosis	0.7	0.85	-0.80	0.78
Behavior	Skew	0.65	0.43	0.16	0.40
	Kurtosis	0.17	0.85	-1.31	0.78
Sifter Total	Skew	0.43	0.43	0.14	0.40
	Kurtosis	0.01	0.85	-0.97	0.78
Sifter Plus	Skew	0.60	0.43	0.07	0.40
	Kurtosis	0.53	0.85	-0.86	0.78
Self-advocacy	Skew	1.04	.44	1.13	.49
	Kurtosis	3.346	.858	.502	.953

Table 37

Tests of Normality for SIFTER Scores

Tests of Normality

	Grouping	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Academics	1.00	.19	29	.008	.83	29	.000
	2.00	.14	35	.067	.95	35	.118
Attention	1.00	.30	29	.000	.79	29	.000
	2.00	.15	35	.036	.91	35	.007
Communication	1.00	.15	29	.081	.95	29	.145
	2.00	.12	35	.200*	.98	35	.706
Participation	1.00	.13	29	.200*	.96	29	.291
	2.00	.13	35	.150	.96	35	.175
Behavior	1.00	.24	29	.000	.87	29	.002
	2.00	.12	35	.200*	.93	35	.026
Self-Advocacy	1.00	.16	28	.079	.91	28	.015
	2.00	.20	22	.020	.85	22	.004
SIFTER TOTAL SIFTER	1.00	.11	29	.200*	.96	29	.375
	2.00	.10	35	.200*	.96	35	.260
SIFTERPLUS SIFTER_PLUS	1.00	.10	29	.200*	.96	29	.361
	2.00	.11	35	.200*	.97	35	.532

* This is a lower bound of the true significance.

[a] Lilliefors Significance Correction

Table 38

t-test for SIFTER Scores

		Levene's Test for Equality of Variances		t-test for Equality of Means							
									Effect Size	95% CI of the Difference	
		F	Sig.	*t*	*df*	Sig. (2-tailed)	Mean Difference	Std. Error Difference	*r*	Lower	Upper
Academics	Equal variances assumed	5.74	.020	1.38	62	.173	1.39	1.01	0.17	-.63	3.41
	Equal variances not assumed			**1.34**	**50.55**	**.186**	**1.39**	**1.04**	**0.19**	**-.69**	**3.48**
Attention	**Equal variances assumed**	.08	.785	**-2.14**	**62**	**.036**	**-2.26**	**1.06**	**0.26**	**-4.37**	**-.15**
	Equal variances not assumed			-2.14	59.06	.037	-2.26	1.06	0.27	-4.38	-.14
Communication	**Equal variances assumed**	1.26	.266	**2.25**	**62**	**.028**	**1.73**	**.77**	**0.28**	**.19**	**3.26**
	Equal variances not assumed			2.22	56.20	.030	1.73	.78	0.28	.17	3.28
Participation	**Equal variances assumed**	.21	.646	**-1.04**	**62**	**.303**	**-.83**	**.80**	**0.13**	**-2.43**	**.77**
	Equal variances not assumed			-1.04	60.06	.303	-.83	.80	0.13	-2.43	.77
Behavior	**Equal variances assumed**	.72	.399	**-2.50**	**62**	**.015**	**-2.18**	**.87**	**0.30**	**-3.92**	**-.44**
	Equal variances not assumed			-2.51	59.89	.015	-2.18	.87	0.31	-3.92	-.44
Self-advocacy	Equal variances assumed	3.46	.069	**-.36**	**48**	**.723**	**-.24**	**.66**	**0.05**	**-1.57**	**1.10**
	Equal variances not assumed			-.34	36.56	.734	-.24	.69	0.06	-1.64	1.16
SIFTER TOTAL	**Equal variances assumed**	.69	.410	**-.67**	**62**	**.504**	**-2.16**	**3.21**	**0.09**	**-8.57**	**4.26**
	Equal variances not assumed			-.68	60.81	.502	-2.16	3.19	0.09	-8.54	4.22
SIFTERPLUS	**Equal variances assumed**	.243	.624	**-.326**	**62**	**.745**	**-1.11**	**3.42**	**0.04**	**-7.94**	**5.717**
	Equal variances not assumed			-.326	59.35	.746	-1.11	3.42	0.042	-7.96	5.73

Table 39

Discriminant Analysis for SIFTER

Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	.36[a]	100.0	100.0	.52

[a] First 1 canonical discriminant functions were used in the analysis.

Wilks's Lambda

Test of Function(s)	Wilks's Lambda	Chi-square	df	Sig.
1	.73	18.29	6	.006

Functions at Group Centroids

Grouping	Function
	1
1.00	.65
2.00	-.54

Unstandardized canonical discriminant functions evaluated at group means

Table 39

(Cont.)

Standardized Canonical Discriminant Function Coefficients

	Function
	1
Academics	.41
Attention	-.26
Communication	.47
Participation	-.34
Behavior	-.60
Self Advocacy	.44

Structure Matrix

	Function
	1
Behavior	-.53
Communication	.48
Attention	-.45
Self Advocacy	.35
Academics	.29
Participation	-.22

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions
Variables ordered by absolute size of correlation within function.

Table 40

Descriptive Statistics: Number of Schools

Descriptives

Grouping				Statistic	Std. Error
Q45_1 # Schools-Preschool	1.00	Mean		1.46	.22
		95% Confidence Interval for Mean	Lower Bound	1.00	
			Upper Bound	1.92	
		5% Trimmed Mean		1.40	
		Skewness		1.42	.46
		Kurtosis		1.00	.89
	2.00	Mean		1.60	.41
		95% Confidence Interval for Mean	Lower Bound	.75	
			Upper Bound	2.45	
		Skewness		1.37	.51
		Kurtosis		1.00	.99
Q45_2 # Schools-Kindergarten-Grade 5	1.00	Mean		1.38	.16
		95% Confidence Interval for Mean	Lower Bound	1.06	
			Upper Bound	1.71	
		Skewness		1.16	.46
		Kurtosis		3.39	.89
	2.00	Mean		1.90	.32
		95% Confidence Interval for Mean	Lower Bound	1.22	
			Upper Bound	2.58	
		Skewness		1.58	.51
		Kurtosis		1.18	.99
Q45_3 # Schools-Grade 6-8	1.0 0	Mean		.81	.19
		95% Confidence Interval for Mean	Lower Bound	.41	
			Upper Bound	1.20	
		Skewness		1.52	.46
		Kurtosis		3.04	.89
	2.00	Mean		1.10	.38
		95% Confidence Interval for Mean	Lower Bound	.30	
			Upper Bound	1.90	
		Skewness		1.78	.51
		Kurtosis		2.62	.99

Table 40

(Cont.)

Descriptives

	Grouping			Statistic	Std. Error
Q45_4 # Schools-High School 9-12	1.00	Mean		.73	.23
		95% Confidence Interval for Mean	Lower Bound	.27	
			Upper Bound	1.20	
		Skewness		2.45	.46
		Kurtosis		7.20	.89
	2.00	Mean		.85	.34
		95% Confidence Interval for Mean	Lower Bound	.13	
			Upper Bound	1.57	
		Interquartile Range		1.00	
		Skewness		2.43	.51
		Kurtosis		6.35	.99

Table 41

t-test for Number of Schools

		Levene's Test for Equality of Variances		*t*-test for Equality of Means							
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Effect Size	95% Confidence Interval of the Difference	
									r	Lower	Upper
Q45_1 # Schools-Preschool	Equal variances assumed	3.68	0.06	**-0.55**	**57.00**	**0.582**	**-0.20**	**0.36**	**0.07**	**-0.92**	**0.52**
	Equal variances not assumed			-0.54	44.35	0.595	-0.20	0.37	0.08	-0.95	0.55
Q45_2 # Schools-Kindergarten-Grade 5	Equal variances assumed	2.42	0.126	**-0.01**	**55.00**	**0.99**	**0.00**	**0.31**	**0.00**	**-0.62**	**0.61**
	Equal variances not assumed			-0.01	46.12	0.991	0.00	0.31	0.00	-0.63	0.63
Q45_3 # Schools-Grade 6-8	Equal variances assumed	1.96	0.171	**-1.50**	**34.00**	**0.144**	**-0.54**	**0.36**	**0.25**	**-1.27**	**0.19**
	Equal variances not assumed			-1.41	21.90	0.174	-0.54	0.38	0.29	-1.33	0.26
Q45_4 # Schools-High School 9-12	Equal variances assumed	1.00	0.325	**-0.92**	**28.00**	**0.363**	**-0.43**	**0.46**	**0.17**	**-1.38**	**0.52**
	Equal variances not assumed			-0.91	24.14	0.373	-0.43	0.47	0.18	-1.40	0.55

Table 42

Descriptive Statistics for Preschool Size

Grouping				Statistic	Std. Error
Q44_1 Size-Preschool	1.00	Mean		2.00	.21
		95% Confidence Interval for Mean	Lower Bound	1.57	
			Upper Bound	2.43	
		Skewness		-.22	.46
		Kurtosis		-.80	.89
	2.00	Mean		1.10	.24
		95% Confidence Interval for Mean	Lower Bound	.60	
			Upper Bound	1.60	
		Skewness		.64	.51
		Kurtosis		-.72	.99
Q44_2 Size-Kindergarten-Grade5	1.00	Mean		2.46	.22
		95% CI for Mean	Lower Bound	2.02	
			Upper Bound	2.91	
		Skewness		-.86	.46
		Kurtosis		.21	.89
	2.00	Mean		2.90	.23
		95% CI for Mean	Lower Bound	2.42	
			Upper Bound	3.38	
		Skewness		.55	.512
		Kurtosis		.37	.99
Q44_3 Size-Middle Grades: Grade 6-8	1.00	Mean		1.69	.34
		95% Confidence Interval for Mean	Lower Bound	.99	
			Upper Bound	2.39	
		Skewness		.22	.46
		Kurtosis		-1.82	.89
	2.00	Mean		1.45	.38
		95% Confidence Interval for Mean	Lower Bound	.65	
			Upper Bound	2.25	
		Skewness		.42	.51
		Kurtosis		-1.77	.99

Table 42

(Cont.)

		Grouping		Statistic	Std. Error
Q44_4 Size-High School: Grades 9-12	1.00	Mean		1.58	.38
		95% Confidence Interval for Mean	Lower Bound	.79	
			Upper Bound	2.36	
		Skewness		.62	.46
		Kurtosis		-1.45	.89
	2.00	Mean		1.50	.45
		95% Confidence Interval for Mean	Lower Bound	.56	
			Upper Bound	2.44	
		Skewness		.82	.51
		Kurtosis		-1.05	.99

Table 43

Crosstabulation and Chi-square of Size of Preschool

Crosstab

Count

		Grouping		
		1.00	2.00	Total
Q44_1 Size-Preschool	1 (Very Small)	4	6	10
	2 (Small)	6	1	7
	3 (Medium)	9	3	12
	4 (Large)	1	0	1
Total		20	10	30

Chi-square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	5.22[a]	3	.16
Likelihood Ratio	5.49	3	.14
Linear-by-Linear Association	3.21	1	.07
N of Valid Cases	30		

[a] 6 cells (75.0%) have expected count less than 5. The minimum expected count is .33.

Table 44

Crosstabulation and Chi-square of Size of Elementary School

Crosstab

Count

		Grouping		
		1.00	2.00	Total
Q44_2 Size-Kindergarten-Grade5	1 (Very Small)	39	22	61
	2 (Small)	79	18	97
	3 (Medium)	33	13	46
	4 (Large)	16	6	22
	5 (Very Large)	0	2	2
Total		167	61	228

Chi-square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	11.56[a]	4	.021
Likelihood Ratio	11.46	4	.022
Linear-by-Linear Association	.00	1	.955
N of Valid Cases	228		

[a] 2 cells (20.0%) have expected count less than 5. The minimum expected count is .54.

Table 45

Crosstabulation and Chi-square Size of Middle School

Crosstab

Count				
		Grouping		
		1.00	2.00	Total
Q44_3 Size-Middle Grades: Grade 6-8	1 (Very Small)	23	5	28
	2 (Small)	51	4	55
	3 (Medium)	16	8	24
	4 (Large)	6	3	9
Total		96	20	116

Chi-square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	9.83[a]	3	.020
Likelihood Ratio	9.69	3	.021
Linear-by-Linear Association	3.49	1	.062
N of Valid Cases	116		

[a] 3 cells (37.5%) have expected count less than 5. The minimum expected count is 1.55.

Table 46

Crosstabulation and Chi-square of Size of High School

Crosstab

Count

		Grouping		
		1.00	2.00	Total
Q44_4 Size-High School: Grades 9-12	1 (Very Small)	15	4	19
	2 (Small)	12	3	15
	3 (Medium)	14	6	20
	4 (Large)	5	1	6
	5 (Very Large)	2	3	5
Total		48	17	65

Chi-square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	3.95[a]	4	.413
Likelihood Ratio	3.57	4	.468
Linear-by-Linear Association	1.71	1	.191
N of Valid Cases	65		

[a] 6 cells (60.0%) have expected count less than 5. The minimum expected count is 1.31.

Table 47

Definition of School Size

	Preschool	Elementary	Middle	High School
1. very small	>10 kids per class	<275 students	<400	<674 students
2. small	11-14	276-400	400-599	674-1346
3. medium	15-19	401-600	600-799	1347-2019
4. large	20-29	601-800	800-999	2020-2692
5. very large	30+	800+	1000+	2692+
Parameter set by:	(Barnett, Schulman, & Shore, December 2004)	(Ready & Lee, 2006)	(Bowen, Bowen, & Richman, 2000)	(Werblow & Duesbery, 2009)

Table 48

Discriminant Results, School Factors

Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	.814[a]	100.0	100.0	.670

[a] First 1 canonical discriminant functions were used in the analysis.

Wilks's Lambda

Test of Function(s)	Wilks's Lambda	Chi-square	df	Sig.
1	.55	23.83	8	.002

Functions at Group Centroids

Grouping	Function
	1
1.00	.774
2.00	-1.006

Unstandardized canonical discriminant functions evaluated at group means

Table 48

(Cont.)

Standardized Canonical Discriminant Function Coefficients

	Function
	1
Q45_1 # Schools-Preschool	-.19
Q45_2 # Schools-Kindergarten- Grade 5	-.92
Q45_3 # Schools-Grade 6-8	-.86
Q45_4 # Schools-High School 9-12	.85
Q44_1 Size-Preschool	1.10
Q44_2 Size-Kindergarten-Grade5	-.38
Q44_3 Size-Middle Grades: Grade 6-8	1.23
Q44_4 Size-High School: Grades 9-12	-.72

Structure Matrix

	Function
	1
Q44_1 Size-Preschool	.48
Q45_2 # Schools-Kindergarten- Grade 5	-.26
Q44_2 Size-Kindergarten-Grade5	-.23
Q45_3 # Schools-Grade 6-8	-.12
Q44_3 Size-Middle Grades: Grade 6-8	.08
Q45_1 # Schools-Preschool	-.05
Q45_4 # Schools-High School 9-12	-.05
Q44_4 Size-High School: Grades 9-12	.02

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions .
Variables ordered by absolute size of correlation within function.

Table 49

Crosstabulation and Chi-square of Gender

Gender Crosstabulation

			Gender			
			Male	Female	Other	Total
Grouping	1.00	Count	80	98	1	179
		% within Grouping	44.7%	54.7%	.6%	100.0%
		% within Gender	73.4%	70.5%	100.0%	71.9%
		% of Total	32.1%	39.4%	.4%	71.9%
	2.00	Count	29	41	0	70
		% within Grouping	41.4%	58.6%	0.0%	100.0%
		% within Gender	26.6%	29.5%	0.0%	28.1%
		% of Total	11.6%	16.5%	0.0%	28.1%
Total		Count	109	139	1	249
		% of Total	43.8%	55.8%	.4%	100.0%

Chi-square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	.645[a]	2	.724
Likelihood Ratio	.914	2	.633
Linear-by-Linear Association	.086	1	.770
N of Valid Cases	249		

[a] 2 cells (33.3%) have expected count less than 5. The minimum expected count is .28.

Table 50

Crosstabulation and Chi-square of Race

		Race						
		White/ Caucasian	Black or African American	American Indian or Alaska Native	Asian	Multiracial	Other	Total
1.00	Count	123	47	0	5	2	2	179
	% within Grouping	68.7%	26.3%	0.0%	2.8%	1.1%	1.1%	100.0%
	% within Race	74.1%	69.1%	0.0%	83.3%	100.0%	50.0%	71.9%
	% of Total	49.4%	18.9%	0.0%	2.0%	.8%	.8%	71.9%
2.00	Count	43	21	3	1	0	2	70
	% within Grouping	61.4%	30.0%	4.3%	1.4%	0.0%	2.9%	100.0%
	% within Race	25.9%	30.9%	100.0%	16.7%	0.0%	50.0%	28.1%
	% of Total	17.3%	8.4%	1.2%	.4%	0.0%	.8%	28.1%
Total	Count	166	68	3	6	2	4	249
	% of Total	66.7%	27.3%	1.2%	2.4%	.8%	1.6%	100.0%

Chi-square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	10.45[a]	5	.063
Likelihood Ratio	10.88	5	.054
Linear-by-Linear Association	.88	1	.349
N of Valid Cases	249		

[a] 8 cells (66.7%) have expected count less than 5. The minimum expected count is .56.

Table 51

Crosstabulation and Chi-square for Ethnicity

Crosstab

			Ethnicity			
			Hispanic/ Latino	Not Hispanic/Latino	Other	Total
Grouping	1.00	Count	4	174	1	179
		% within Grouping	2.2%	97.2%	.6%	100.0%
		% within Ethnicity	36.4%	73.7%	50.0%	71.9%
		% of Total	1.6%	69.9%	.4%	71.9%
	2.00	Count	7	62	1	70
		% within Grouping	10.0%	88.6%	1.4%	100.0%
		% within Ethnicity	63.6%	26.3%	50.0%	28.1%
		% of Total	2.8%	24.9%	.4%	28.1%
Total		Count	11	236	2	249
		% of Total	4.4%	94.8%	.8%	100.0%

Chi-square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	7.74[a]	2	.021
Likelihood Ratio	6.81	2	.033
Linear-by-Linear Association	4.68	1	.030
N of Valid Cases	249		

[a] 3 cells (50.0%) have expected count less than 5. The minimum expected count is .56.

Table 52

Crosstabulation and Chi-square of Additional Disability

Crosstab

			Presence of Additional Disability		
			Additional Disability	No Additional Disability	Total
Grouping	1.00	Count	8	171	179
		% within Grouping	4.5%	95.5%	100.0%
		% within Presence of Additional Disability	25.8%	78.4%	71.9%
		% of Total	3.2%	68.7%	71.9%
	2.00	Count	23	47	70
		% within Grouping	32.9%	67.1%	100.0%
		% within Presence of Additional Disability	74.2%	21.6%	28.1%
		% of Total	9.2%	18.9%	28.1%
Total		Count	31	218	249
		% of Total	12.4%	87.6%	100.0%

Chi-square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-square	37.21[a]	1	.000		
Continuity Correction[b]	34.65	1	.000		
Likelihood Ratio	33.14	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	37.06	1	.000		
N of Valid Cases	249				

[a] 0 cells (0.0%) have expected count less than 5. The minimum expected count is 8.71.
[b] Computed only for a 2x2 table

Table 53

Discriminant Analysis of Child Characteristics

Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	.19[a]	100.0	100.0	.397

[a] First 1 canonical discriminant functions were used in the analysis.

Wilks's Lambda

Test of Function(s)	Wilks's Lambda	Chi-square	df	Sig.
1	.84	41.94	4	.000

Functions at Group Centroids

	Function
Grouping	1
1.00	.27
2.00	-.69

Unstandardized canonical discriminant functions evaluated at group means

Standardized Canonical Discriminant Function Coefficients

	Function
	1
Q50 Gender	-0.12
Q48 Race	0.00
Q49 Ethnicity	0.23
Q69 Presence of Additional Disability	0.95

Table 53

(Cont.)

Structure Matrix

	Function
	1
Q69 Presence of Additional Disability	0.97
Q49 Ethnicity	0.32
Q48 Race	-0.14
Q50 Gender	-0.04

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions
Variables ordered by absolute size of correlation within function.

Table 54

Descriptive Statistics Family Characteristics

Group Statistics

	Grouping	*N*	*M*	*SD*	SE Mean
Q9 Household Income	1.00	35	6.66	3.39	0.57
	2.00	28	6.50	2.66	0.50
Q3 Highest level of education of MOTHER	1.00	35	6.43	2.05	0.35
	2.00	28	5.32	2.11	0.40
Q38 Highest level of education of FATHER	1.00	35	5.34	1.96	0.33
	2.00	28	5.21	2.06	0.39
Q8 # of adults AND children in household?	1.00	35	2.97	0.79	0.13
	2.00	28	2.75	1.21	0.23

Table 55

T-test for Family Characteristics

Independent Samples Test

		Levene's Test for Equality of Variances		*t*-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	SE Difference	Lower	Upper
Q9 Household Income	Equal variances assumed	2.43	0.124	0.20	61.00	0.841	0.16	0.78	-1.41	1.72
	Equal variances not assumed			0.21	60.99	0.837	0.16	0.76	-1.37	1.68
Q3 Highest level of education of MOTHER	Equal variances assumed	0.02	0.903	2.10	61.00	0.039	1.11	0.53	0.06	2.16
	Equal variances not assumed			2.10	57.23	0.04	1.11	0.53	0.05	2.16
Q38 Highest level of education of FATHER	Equal variances assumed	0.11	0.745	0.25	61.00	0.801	0.13	0.51	-0.89	1.14
	Equal variances not assumed			0.25	56.57	0.802	0.13	0.51	-0.89	1.15
Q8 # of adults AND children in household?	Equal variances assumed	7.14	0.01	0.88	61.00	0.383	0.22	0.25	-0.28	0.73
	Equal variances not assumed			0.84	44.38	0.406	0.22	0.26	-0.31	0.75

Table 56

Crosstabulation and Chi-square of Family Language

			Primary Home Language						
			English	Chinese (Cantonese or Mandarin)	French	Vietnamese	American Sign Language	Other (specify)	Total
Grouping	1.00	Count	33	0	1	0	1	0	35
		% within Grouping	94.3%	0.0%	2.9%	0.0%	2.9%	0.0%	100.0%
		% within Primary Home Language	56.9%	0.0%	100.0%	0.0%	100.0%	0.0%	55.6%
		% of Total	52.4%	0.0%	1.6%	0.0%	1.6%	0.0%	55.6%
	2.00	Count	25	1	0	1	0	1	28
		% within Grouping	89.3%	3.6%	0.0%	3.6%	0.0%	3.6%	100.0%
		% within Primary Home Language	43.1%	100.0%	0.0%	100.0%	0.0%	100.0%	44.4%
		% of Total	39.7%	1.6%	0.0%	1.6%	0.0%	1.6%	44.4%
Total		Count	58	1	1	1	1	1	63
		% within Grouping	92.1%	1.6%	1.6%	1.6%	1.6%	1.6%	100.0%
		% within Primary Home Language	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	92.1%	1.6%	1.6%	1.6%	1.6%	1.6%	100.0%

Table 56

(Cont.)

Chi-square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	5.39[a]	5	.370
Likelihood Ratio	7.26	5	.202
Linear-by-Linear Association	.29	1	.590
N of Valid Cases	63		

[a] 10 cells (83.3%) have expected count less than 5. The minimum expected count is .44.

Table 57

Crosstabulation and Chi-square of Family Secondary Language

Crosstab

			Secondary Home Language						
			None	English	Spanish	Chinese (Cantonese or Mandarin)	American Sign Language	Other (specify)	Total
Grouping	1.00	Count	167	4	1	0	4	3	179
		% within Grouping	93.3%	2.2%	.6%	0.0%	2.2%	1.7%	100.0%
		% within Secondary Home Language	74.6%	50.0%	33.3%	0.0%	40.0%	100.0%	71.9%
		% of Total	67.1%	1.6%	.4%	0.0%	1.6%	1.2%	71.9%
	2.00	Count	57	4	2	1	6	0	70
		% within Grouping	81.4%	5.7%	2.9%	1.4%	8.6%	0.0%	100.0%
		% within Secondary Home Language	25.4%	50.0%	66.7%	100.0%	60.0%	0.0%	28.1%
		% of Total	22.9%	1.6%	.8%	.4%	2.4%	0.0%	28.1%
Total		Count	224	8	3	1	10	3	249
		% of Total	90.0%	3.2%	1.2%	.4%	4.0%	1.2%	100.0%

Table 57

(Cont.)

Chi-square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	13.65[a]	5	.018
Likelihood Ratio	13.35	5	.020
Linear-by-Linear Association	3.25	1	.071
N of Valid Cases	249		

[a] 8 cells (66.7%) have expected count less than 5. The minimum expected count is .28.

Table 58

Crosstabulation and Chi-square of Family Structure

Crosstab

			Household Setting							
			Rather not say	Two Parent Family	Single Parent	Widowed Parent	Blended Family	Multiple Generation Family	Other	Total
Grouping	1.00	Count	2	30	0	1	0	1	1	35
		% within Group	5.7%	85.7%	0.0%	2.9%	0.0%	2.9%	2.9%	100%
		% within Setting	66.7%	62.5%	0.0%	100%	0.0%	50.0%	50%	55.6%
		% of Total	3.2%	47.6%	0.0%	1.6%	0.0%	1.6%	1.6%	55.6%
	2.00	Count	1	18	3	0	4	1	1	28
		% within Group	3.6%	64.3%	10.7%	0.0%	14.3%	3.6%	3.6%	100%
		% within Setting	33.3%	37.5%	100%	0.0%	100%	50.0%	50.0%	44.4%
		% of Total	1.6%	28.6%	4.8%	0.0%	6.3%	1.6%	1.6%	44.4%
Total		Count	3	48	3	1	4	2	2	63
		% of Total	4.8%	76.2%	4.8%	1.6%	6.3%	3.2%	3.2%	100%

Table 58

(Cont.)

Chi-square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	10.69[a]	6	.099
Likelihood Ratio	13.68	6	.033
Linear-by-Linear Association	2.08	1	.150
N of Valid Cases	63		

[a] 12 cells (85.7%) have expected count less than 5. The minimum expected count is .44.

Table 59

Crosstabulation and Chi-square of Family Community Setting

Crosstab

			Community Type				
			Urban	Suburban	Rural	Town	Total
Grouping	1.00	Count	5	25	2	3	35
		% within Grouping	14.3%	71.4%	5.7%	8.6%	100.0%
		% within Community Type	45.5%	67.6%	22.2%	50.0%	55.6%
		% of Total	7.9%	39.7%	3.2%	4.8%	55.6%
	2.00	Count	6	12	7	3	28
		% within Grouping	21.4%	42.9%	25.0%	10.7%	100.0%
		% within Community Type	54.5%	32.4%	77.8%	50.0%	44.4%
		% of Total	9.5%	19.0%	11.1%	4.8%	44.4%
Total		Count	11	37	9	6	63
		% of Total	17.5%	58.7%	14.3%	9.5%	100.0%

Chi-square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	6.74[a]	3	.081
Likelihood Ratio	6.92	3	.074
Linear-by-Linear Association	.61	1	.433
N of Valid Cases	63		

[a] 4 cells (50.0%) have expected count less than 5. The minimum expected count is 2.67.

Table 60

Discriminant Analysis of Family Characteristics

Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	.16[a]	100.0	100.0	.37

[a] First 1 canonical discriminant functions were used in the analysis.

Wilks's Lambda

Test of Function(s)	Wilks's Lambda	Chi-square	df	Sig.
1	.87	8.28	8	.407

Functions at Group Centroids

	Function
Grouping	1
1.00	-0.35
2.00	0.44

Unstandardized canonical discriminant functions evaluated at group means

Table 60

(Cont.)

Standardized Canonical Discriminant Function Coefficients

	Function 1
Q1 Primary Home Language	0.38
Q60 Secondary Home Language	0.02
Q9 Household Income	0.07
Q3 Highest level of education of MOTHER	-0.93
Q38 Highest level of education of FATHER	0.20
Q5 Household Setting	0.48
Q7 Community Type	0.11
Q8 # of adults AND children in household?	-0.23

Structure Matrix

	Function 1
Q3 Highest level of education of MOTHER	-0.68
Q5 Household Setting	0.47
Q8 # of adults AND children in household?	-0.29
Q7 Community Type	0.25
Q1 Primary Home Language	0.17
Q60 Secondary Home Language	0.09
Q38 Highest level of education of FATHER	-0.08
Q9 Household Income	-0.07

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions
Variables ordered by absolute size of correlation within function.