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Adverse Childhood Experiences in Mothers and Their Children with Hearing Loss

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Abstract
This study examined the relationship between maternal and child adverse childhood experiences (ACEs) in children with hearing loss ages 3–12 years old. Mother and child ACE assessments were completed by 124 mother-child dyads. ACEs were measured using the Center for Youth Wellness Adverse Childhood Experiences Questionnaire (CYW ACE-Q; Burke Harris & Renschler, 2015).

Both maternal and child participants in this study reported higher levels of ACE exposure than previously reported in studies of the general population. Maternal and child ACEs were significantly correlated. White/Caucasian mothers experienced significantly fewer ACEs than mothers of other races/ethnicities. Children living in adoptive, foster, or guardianship placements experienced significantly more ACEs than children living with their biological mothers. The results of this study suggest that maternal and child ACEs are significantly correlated in children with hearing loss and their mothers, as has been found in literature on hearing mother-child dyads.

Keywords: children who are deaf and hard of hearing, hearing loss, trauma-informed care, adverse childhood experiences

Acronyms: ACE = adverse childhood experience; CYW ACE-Q = Center for Youth Wellness Adverse Childhood Experiences Questionnaire; PTA = pure tone average

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Parent-child relationships are the foundation from which all learning begins (Ainsworth, 1979; Bowlby, 1988). When infants' early communicative attempts are met with attentive, consistent, emotionally responsive caregiving, their brains have the opportunity to establish the foundations of pre-linguistic development. Higher levels of maternal responsivity have been associated with improved language outcomes for both children with typical hearing (Spencer & Meadow-Orlans, 1996; Yoder & Warren, 1999) and children with hearing loss (Quittner et al., 2013). Maternal responsiveness and parent-child relationships, in general, are supportive factors for the development of language skills (Bee et al., 1982; Mistry et al., 2010). In contrast, exposure to adverse childhood experiences (ACEs), such as child abuse, neglect, maltreatment, inconsistent caregiving, poverty and so on is a risk factor for child development (Felitti et al., 1998).

This study used self- and parent-report measures of maternal and child ACE exposure to investigate the relationships between maternal and child adverse experiences in mother-child dyads of children with hearing loss. Children ages three to twelve years old, with any degree of permanent, bilateral hearing loss, were studied in mother-child dyads.

Background

Children with Hearing Loss

For the purposes of this study, *children with hearing loss* are considered to be any children with permanent, bilateral hearing loss of any type (sensorineural, conductive, or mixed) or degree (mild, moderate, severe, or profound) as determined by the child's most recent audiological diagnosis. In the literature, this population is referred to with various terms: deaf, Deaf, hard of hearing, hearing loss, and so on. The current study investigated hearing parents and their deaf children who have elected to use listening and spoken language for communication. The children studied have varying degrees of hearing loss, and are as of yet too young (ages 3 to 12 years old) to articulate a preference for a cultural versus medical model of identification for their deafness. Thus, the term *children with hearing loss* will be used throughout to discuss this group as a whole.

Adverse Childhood Experiences (ACEs)

Adverse childhood experiences, or ACEs, refer to a diverse set of potentially traumatic events in childhood that may be unfavorable to health and development across the lifespan (Shonkoff & Garner, 2012). Although various ACE scales exist, most include questions regarding the child's/family's economic security (ability to consistently secure adequate food and shelter), physical abuse (directed toward and/or witnessed by the child), sexual abuse, mental health of the child's primary caregiver(s), and presence/absence of positive, supportive adult figures. Expanded ACE questionnaires, such as the Center for Youth Wellness Adverse Childhood Experiences Questionnaire - Child (CYW ACE-Q Child) used in this study, also include questions about neighborhood violence, immigration, and school bullying/harassment (Burke Harris & Renschler, 2015).

Literature Review

Theoretical Framework

Ecological Systems Theory

This study investigates language development in children with hearing loss from the perspective of the *ecological systems theory* (also called human ecology or development in context; Bronfenbrenner, 1979). Ecological systems theory views human development as the product of interaction between the individual and her environment, both micro (family systems) and macro (broad societal and cultural factors). As such, language development for a child with hearing loss cannot be seen as a function of the child's audiological status, age of identification, etiology, or other personal factors alone, but must instead be viewed in the context of that child's interaction with her family, culture, and society. This theory posits that "what matters for behavior and development is the environment as it is *perceived* rather than as it may exist in an 'objective' reality" (Bronfenbrenner, 1979, p. 4), lending credence to the use of participant self-report measures (i.e., the *Parent Child Relationship Inventory* and *Adverse Childhood Experiences Questionnaire* used in this study). Likewise, while parent-child dyads were assessed in this study, items on the assessment material probed the dyad's larger ecological context, as Bronfenbrenner (1979) noted that

> The capacity of a dyad to serve as an effective context for human development is crucially dependent on the presence and participation of third parties, such as spouses, relatives, friends, and neighbors. If such third parties are absent, or if they play a disruptive rather than a supportive role, the developmental process, considered as a system, breaks down; like a three-legged stool, it is more easily broken if one leg is broken, or shorter than the others. (p. 5)

Bonfenbrenner is credited with shifting the field of child development from a focus on assessing the construct of *attachment* in single-instance *strange situation tasks* in which a child's reaction to separation from a caregiver in a new environment is evaluated (Ainsworth & Bell, 1970) to an appreciation of "contextual variation in human development" (Darling, 2007, p. 203).

Seligman and Benjamin Darling (2007) expand on this framework in the specific context of families with children with disabilities, noting the interconnected nature of all aspects of the family and social system, stating, "each variable in any system interacts with the other variables so thoroughly that cause and effect cannot be separated" (p. 17). Algood et al. (2011) further explored childhood disability through the perspective of ecological systems theory by noting that the presence of protective factors in the child's social circles can shield children with disabilities from maltreatment. For example, early intervention focused on promoting responsive caregiver-child interaction may serve as a barrier against maltreatment by improving the functioning of the family system. For children with disabilities, and all children, development is most holistically viewed in the context of their immediate family relationships as well as broader environmental and sociological phenomena.

Adverse Childhood Experiences

Parental ACEs

Research has demonstrated that parents who exhibit higher levels of adverse experiences during their own childhoods are more likely to exhibit difficulties in relationships with their own children, which often has a cascading effect on child mental health and childhood behavior problems, both internationalizing and externalizing (Stepleton et al., 2018). A study of Head Start participants and their mothers (Randall et al., 2015) found that parental ACE exposure was highly correlated with children's experiences of adversity, noting that, "there was a strong positive association between parental ACE and childhood adversity" and that "this association was strongest among parents with an ACE score of 4 or more, indicating a dose-response relationship" (p. 786).

In addition to the correlation between parent and child ACE scores, parental ACEs have also been associated with deleterious effects on child development, starting even before birth. Mothers with higher ACE scores were more likely to consume alcohol during pregnancy (Frankenberger et al., 2015). Parental mental health has been implicated in negative social and academic outcomes for children (e.g., grade retention, internalizing and externalizing behavior disorders), independent from the children's own ACE scores (Porche et al., 2016). Folger et al. (2018) found that "for each additional maternal ACE, there was an 18% increase in the risk for a suspected developmental delay" (p. 4) among a sample of two-year-old children (311 mother-child dyads and 122 father-child dyads). In addition to the risk of developmental delay, children of parents with higher ACE scores are at increased risk for receiving a diagnosis of Attention Deficit Hyperactivity Disorder (ADHD) and/or behavioral disorders (Schickedanz et al., 2018).

Mothers' ACE scores affect their own parenting practices. Mothers who reported experiencing physical abuse in their own childhoods were significantly more likely to use corporal punishment and spanking as means of discipline with their own children (Chung et al., 2009). In their study of mothers without psychological diagnoses, mothers with depression, and mothers with depression and/or Post-Traumatic Stress Disorder (PTSD), Chemtob et al. (2013) found that mothers with a PTSD diagnosis demonstrated greater physical aggression toward their children and had children who were more likely to be exposed to traumatic experiences themselves.

Factors related to parental/maternal ACE scores have been implicated in child language development. Mothers with depression have been shown to provide poorer-quality caregiving to their offspring, which affects child language when measured at 36 months of age in children with typical hearing (Stein et al., 2008). Likewise, Paulson et al. (2009) found that parental mental health influences the amount of parent-child reading time, another key component in language development. In a factor analysis of mother-child relationships to describe factors linked to child language delay, Sylvestre and Mérette (2010) identified child cognitive development, the mother's history of her own physical and emotional childhood abuse, and mothers' responsivity to their children as the strongest predictors of language disorders in children who have been neglected. Torrisi et al. (2018) linked maternal exposure to interpersonal violence and maternal post-traumatic stress disorder to maternal caregiving behavior and found a relationship between this caregiving behavior and child language outcomes. Thus, maternal ACE scores affect not only the mother, but also her children's health, growth, and development.

Childhood ACEs

Although ACE questionnaires may be used retrospectively for adults reflecting on events that occurred prior to their eighteenth birthdays, evaluations of pediatric ACEs assess any potentially traumatic life events children have experienced or are currently experiencing. In their

meta-analysis of 241 publications and 551 prevalence rates for child abuse worldwide, Stoltenborgh et al. (2015) found that, although reports of child sexual abuse was most prevalent in the literature, overall rates of child abuse of all types, including neglect and emotional abuse, were quite high worldwide, and concluded, "child maltreatment is a widespread, global phenomenon affecting the lives of millions of children all over the world" (p. 37). In the United States specifically, 7.4 million children were reported to Child Protective Services nationally and 1,750 abuse-related child fatalities were recorded in the year 2016, the last year for which data is available (U.S. Department of Health & Human Services, 2018). Additional children experienced non-abuse related ACEs, such as the death of a caregiver, a serious or chronic illness, or neighborhood violence or discrimination (van der Kolk, 2005).

Another factor assessed in ACE questionnaires is whether or not the child/family have experienced markers of poverty, such as homelessness, food insecurity, or use of other social benefits (e.g., welfare, food stamps). Material deprivation in childhood is tied to a variety of deleterious effects. Particularly germane to this study are the effects of childhood poverty on cognition and language for children with and without hearing loss. Numerous researchers have found that socioeconomic status predicted both the size and rate of growth of two year olds' vocabularies, with children of high socioeconomic status achieving higher scores, likely due to both quality and quantity of child-directed speech from their mothers (Hart & Risley, 1992; Hoff-Ginsberg, 1998; Pungello et al., 2009; Raviv et al., 2004). Similar findings have been reported linking socioeconomic status with language outcomes in children with hearing loss (Niparko et al., 2010).

Exposure to adverse childhood experiences also predisposes children to respond disproportionately to later stressful but non-traumatic events of daily life, leading to higher incidences of both internalizing and externalizing behavior disorder symptomatology (Grasso et al., 2013). Perry et al. (1995) describe this as the transition from "states" to "traits," that is, while hyperarousal and dissociation are natural responses to a stressor, children living in environments that are chronically stressful and traumatic may remain in such states to the point that it is maladaptive for learning and retaining new information as well as forming healthy relationships. Sheridan and McLaughlin (2016) argue that these adverse experiences (e.g., decreased cognitive enrichment, increased exposure to violence) affect children's brains through the neurobiological process of neuroplasticity, influencing the development of both emotional control and cognitive control in ways that prove disadvantageous for later academic success.

These difficulties in developing relationships, executive function skills, and emotional reciprocity affect child language development, a principal concern in this study. Children with a history of abuse and neglect score significantly worse than their non-affected peers on measures of language and social development (Cobos-Cali et al., 2018; Lum et al., 2018). Even when controlling for other aspects that are known to affect cognitive development (i.e., demographic and socioeconomic factors, birth weight, maternal IQ, and the amount of stimulation in the home), exposure to interpersonal trauma has a significant, independent effect on children's IQ scores. Children exposed to trauma in the first two years of life, on average, score half a standard deviation lower than their non-trauma-exposed peers (Enlow et al., 2012). For children who experience childhood maltreatment and do not receive therapeutic intervention, studies note a significant delay in language scores when compared to both peers who have not experienced ACEs and peers who have experienced ACEs but received intervention (Culp et al., 1987). Allen and Wasserman (1985) hypothesized that the delays in language observed among children who have been abused may be tied to mothers' ignoring behaviors and lack of cognitive stimulation.

Although the literature has established that exposure to adverse childhood experiences has undeniably negative effects on child development across domains (and throughout the lifespan), any discussion of trauma would be incomplete without a recognition of the amazing capacity of humans to develop resilience in the face of difficulty, and the factors that contribute to children's resilience in the face of trauma. In their discussion of five modifiable factors to promote resilience in the face of childhood adversity, Traub and Boynton-Jarrett (2017) identify parenting and the treatment of maternal mental health issues as keys to improving child outcomes, supporting the present investigation's inclusion of maternal ACE scores in our analysis. Masten et al. (1990) identified several characteristics that predispose a child to recover more successfully from adverse childhood experiences, including, most notably for the purposes of this study, relationships with competent adults and the ability to engage with other people (strongly tied to language skills).

ACEs in Populations of Individuals with Hearing Loss

Minimal research has been conducted investigating the effects of adverse childhood experiences for the population of people with hearing loss. Some research (e.g., Kushalnagar et al., 2020) probes the self-reports of adults who are deaf or hard of hearing of "adverse childhood communication experiences" and links this to poorer adult health outcomes but does not strictly measure ACE exposure as broadly defined in the psychomedical literature. Kvam and Loeb (2010) reported an association between self-reports of childhood adverse experiences and current mental health problems for Norwegian adults who were deaf. Although there are no prior investigations of ACEs among children with hearing loss, it is hypothesized that higher rates of adverse childhood experiences or disruptions in attachment have cascading effects on higher-order neurodevelopment. For the purposes of this study, language development is investigated as a proxy marker of higher-order neurodevelopment, as it is a historical area of weakness of children with hearing loss when compared with their hearing peers, even when matched by age and socioeconomic status (Tomblin et al., 2015).

Purpose of the Study

Although advances in hearing technology, early intervention, and special education law have greatly improved language, academic, and social outcomes for children with hearing loss, there remains a subset of children who are deaf or hard of hearing whose listening, speech, and language outcomes lag behind their peers—both those with hearing loss and without (Ching, 2015; Moeller, 2000; Moeller & Tomblin, 2015; Yoshinaga-Itano et al., 1998). In addition to access to assistive technology and intervention, best practices in family-centered early intervention for children with hearing loss and their families recognize the importance of comprehensive social-emotional support and attention to environmental and relational factors as critical ingredients in achieving desired language outcomes (Moeller et al., 2013). Thus, although there are many plausible explanations for this phenomenon that relate directly to hearing loss (e.g., late identification, abnormal cochlear etiology, lack of highly qualified service providers), another source of this variation in outcomes may be found in more general factors, such as ACE exposure and parental self-efficacy.

Significant bodies of research exist on both the effects of parenting, parent-child interactions, and language outcomes for children both with and without hearing loss (National Institute of Child Health, 2000; Quittner et al., 2010; Quittner et al., 2013) and the negative developmental effects of ACEs in general (Jimenez et al., 2016) yet there is relatively little research examining the relationship between maternal and child ACEs for children with hearing loss. This population is at an increased risk for childhood maltreatment (Schenkel et al., 2014). De Bellis (2001) proposed that, "the potential psychobiological sequelae of child maltreatment may be regarded as an *environmentally induced complex developmental disorder*" (p. 540). What, then, are the compounding effects of this "environmentally induced complex developmental disorders" on children who already have a diagnosis of another communication disorder—hearing loss—and how might maternal trauma history affect children's experiences?

Although previous studies have documented abuse and maltreatment of children and young adults who are deaf or hard of hearing (e.g., Titus, 2010), there are no prior investigations of ACEs in young children with hearing loss. The current study aims to integrate current knowledge on maternal-child relationships and language outcomes with the field's emerging focus on ACEs to investigate the relationship of both of these potential risk factors for the population of children with hearing loss who use spoken language. Voss and Lenihan (2016) note that although professionals serving children with hearing loss often serve families in poverty or other adverse circumstances, personnel preparation programs rarely include adequate (if any) instruction in working with families who have experienced trauma. These programs focus more on the technical and educational aspects of language development for children with hearing loss. Instruction regarding the role of ACEs and parent-child attachment is lacking in both preprofessional preparation for students of speech-language pathology, audiology, and deaf education, and professional development for practitioners and educators in the field. Finally, the link between social-emotional risk and protective factors and language outcomes is under-investigated (Voss & Lenihan, 2016). Ko et al. (2008) concur, noting that professionals in the healthcare and education systems receive little to no training on how to create trauma-informed practices to best serve children and families who have experienced ACEs, stress, or disruptions in the parent-child relationship. The results of this study have the potential to inform clinical practice by encouraging professionals to expand their clinical focus to include children's and families' interaction patterns and overall psychosocial wellbeing in addition to speech, language, and listening targets by demonstrating the interrelated nature of these constructs.

This study sought to investigate the correlation between maternal and child ACE exposure in children with hearing loss and the demographic factors that influenced ACE exposure in this population. Both general variables (e.g., age, race, education, income) found to affect ACE exposure in the literature more broadly as well as deafness-specific factors (e.g., degree of hearing loss, communication mode, and language) were selected to probe the ways in which this population is similar to, or different from, previous data on maternal-child ACE correlations in dyads with typical hearing.

Method

Participants

In this investigation, children ages three to twelve years of age with hearing loss (defined as children with any degree or type of permanent, bilateral hearing loss as determined by their most recent audiological diagnosis) and their mothers were studied to assess the relationship between maternal and child ACE scores. Participants were biological, adoptive, or foster/guardian mother-child pairs. Although some participants reported using languages other than English at home, all mothers in the study were able to complete study forms and assessments in English. Participants were recruited via professional listservs, conferences, and social media from cochlear implant centers, audiological clinics, educational programs for children with hearing loss, and private therapy centers across North America. Participants hailed from a wide range of rural, suburban, and urban locales across North America. Following approval by the Institutional Review Board of Teachers College, Columbia University; 124 mother-child dyads consented to participate in the study. The sample size was selected in line with best practices as established by the Council on Exceptional Children for experimental group design studies in special education (Gersten et al., 2005). Maternal and child participant demographics are presented in Table 1 and Table 2, respectively.

Children's Hearing Loss and Hearing Technology

Mothers reported their child's degree of hearing loss based on the child's Pure Tone Average (PTA; calculated as the average of the child's unaided hearing thresholds at 500, 1000, and 2000Hz, respectively). Slightly under half of the children in this study (57 [46.0%]) had profound hearing loss (PTA of 90 dB or greater). The most common age at identification of hearing loss was at birth (60 [48.4%]) for children in this study. Children's hearing technology use was reported for their left and right ears, respectively. Children in the study reported use of cochlear implants, bone conduction devices, and hearing aids, and some children reported non-use of hearing technology for one or both affected ears.

Children's Intervention and Communication Characteristics

The majority of the children used listening and spoken English as their primary communication mode (89 [71.8%]). Twenty-three (18.5%) children were reported to use total communication, seven (5.6%) used American Sign Language or another visual language, and five children (4.0%) were reported to use a spoken language or languages other than English as their primary mode of communication. Other spoken languages used by the children in this sample included Portuguese, Danish, French, German, Hebrew, Hungarian, Italian, Romanian, Russian, and Spanish. Children in this study were enrolled in a range of intervention methods and settings, including individual, family-centered, outpatient Auditory Verbal Therapy, speech-language therapy services, group/center-based educational programs for children with hearing loss, home-based early intervention, and/or instruction in visual communication (e.g., sign language(s) or cued speech).

Assessments

Demographic Questionnaire

To collect information on the demographic variables analyzed in this study, mothers were asked to complete a demographic questionnaire about themselves and their children.

Center for Youth Wellness Adverse Childhood Experiences Questionnaire (CYW ACE-Q)

ACE scores were collected, with parents serving as the reporters, for both the parents' own childhood experiences and their children's, using the Center for Youth Wellness Adverse Childhood Experiences Questionnaire (CYW

Table 1

Demographic Characteristics of Maternal Participants

Characteristic	Mothers	
	n	%
Hearing status		
Hearing	119	96
Deaf/hard of hearing	5	4
Native language		
English	112	90.3
Portuguese	2	1.6
Romanian	2	1.6
Italian	2	1.6
Kannada	1	.8
Spanish	1	.8
Hungarian	1	.8
Filipino	1	.8
Hungarian	1	.8
Iceland	1	.8
Age		
Under 29 years old	4	3.2
30-39 years old	72	58.1
Over 40 years old	48	38.7
Race/ethnicity		
White/Caucasian	105	84.7
Asian	6	4.8
Black/African American	5	4.0
Hispanic/Latino/a	5	4.0
Multiracial	2	1.6
Other	1	.8
Highest level of education		
High school diploma	13	10.2
Bachelor's degree	56	45.2
Master's, professional, or doctoral degree	55	44.6
Family income (yearly, in USD)		
Under $40,000	6	4.8
$40,000-49,000	6	4.8
$50,000-59,000	9	7.3
$60,000-69,000	6	4.8
$70,000-79,000	10	8.1
$80,000-89,000	8	6.5
$90,000-99,000	14	11.3
Over $100,000	65	52.4

Table 2

Demographic Characteristics of Child Participants

Characteristic	Children	
	n	%
Gender		
Female	71	57.3
Male	53	42.7
Race/ethnicity		
White/Caucasian	92	74.2
Asian	10	8.1
Black/African American	5	4.0
Hispanic/Latino/a	6	4.8
Multiracial	8	6.5
Other	3	2.4
Family status		
Biological	111	89.5
Adoptive/foster	13	10.5
Additional disabilities*		
No	84	67.7
Yes	40	32.3
Pure Tone Average (PTA)		
Mild	7	5.6
Moderate	15	12.1
Severe	10	8.1
Profound	57	46.0
Unreported	19	15.3
Primary mode of communication		
Spoken English	89	71.8
Total communication	23	18.5
Visual communication (American Sign Language or other signed language)	7	5.6
Spoken language other than English	5	4.0

*Additional disabilities reported included: Ehlers Danlos Syndrome, failure to thrive, SLC6A1 genetic mutation, epilepsy, global developmental delay, Post-Traumatic Stress Disorder, apraxia of speech, kidney malformations, vertebral malformation, hyperparathyroidism, congenital cytomegalovirus, Attention Deficit Hyperactivity Disorder, Usher Syndrome, Binder Syndrome, Disruptive Mood Dysregulation Disorder, skeletal disorders, 16p13.3 deletion, Generalized Anxiety Disorder, Sensory Processing Disorder, speech and language impairment, dyslexia, microtia/atresia, Duane Syndrome, cardiac malformations, prematurity, low muscle tone, craniofacial disorders, anxiety, mitochondrial DNA mutation, Pendred Syndrome, neurogenic bladder, asthma, Auditory Neuropathy Spectrum Disorder, vision impairment, cleft palate, feeding and digestive issues, Von Willebrand's Disease, Ring 13 chromosomal disorder, microcephaly, and Dandy Walker Syndrome.

ACE-Q; Burke Harris & Renschler, 2015). The ACE-Q has versions for children, teens, and adults/parents. Each questionnaireasks respondents to indicate the number of adverse childhood events they have experienced, though respondents are not asked to reveal the exact ACEs they have experienced. ACEs in the questionnaire include things such as, "At any point since your child was born…your child's parents or guardians were separated or divorced," "…your child lived with someone who had a problem with drinking or using drugs," and "…your child often saw or heard violence in the neighborhood or in her/his school neighborhood." Items are categorized into two groups. The first covers the original 10 ACEs identified by the seminal Adverse Childhood Experiences study from the Kaiser Permanente health system (Felitti et al., 1998) and the second includes additional "early life stressors" (Bucci et al., 2015, p. 10). The instrument takes respondents between two and five minutes to complete and yields a numerical score for each of the two groups of items for research purposes. For scoring purposes, the total score is used (Bucci et al., 2015). A total score of greater than or equal to four ACEs endorsed indicates clinically significant exposure to adverse childhood experiences, as does a score of 1 to 3 with symptomatology (Bucci et al., 2015). For the purposes of this study, ACE scores of 0 to 3 were classed as *low ACEs* and ACE scores greater than or equal to four were put in the *high ACEs* category. No formal assessments of psychopathology were conducted as part of this study, and symptomatology was not considered as a factor in classifying participants into the low or high ACE groups.

In this study, we investigated both maternal and child ACE scores. Mothers were asked to complete the ACE-Q twice,

once for themselves and once on behalf of their child. When inquiring about mothers' own adverse experiences, the original ACE-Q Child assessment was modified by the researcher, changing language from "At any point since your child was born…" to "At any point before your eighteenth birthday…" for mothers to report on their own experiences. Both mothers' and children's total ACE scores were grouped into low ACEs (0-3 total score) and high ACEs (total score greater than or equal to 4) for the purposes of categorical analysis.

A copy of the CYW ACE-Q is included as Appendix A. This study's adaptation of the CYW ACE-Q for maternal participants is included as Appendix B.

Results

Preliminary Data Analysis

Primary data analysis was conducted using IBM SPSS version 26 for Mac, with Alpha for all significance tests set at $p < .05$ (two-tailed). All analyses were conducted by the primary investigator and reviewed by two additional colleagues in the field of Education for the Deaf or Hard of Hearing with PhDs and at least three years' experience with advanced statistics courses.

Center for Youth Wellness Adverse Childhood Experiences Questionnaire (CYW ACE-Q)

All mothers who participated in this study completed the CYW ACE-Q, reporting on the number of adverse childhood experiences (ACEs) that they had experienced before the age of eighteen and the number of ACEs their child had experienced in his/her lifetime, respectively. Both mothers and children reported ACE scores ranging from 0 to 13, though mothers had a higher average ACE score ($M = 2.63$, $SD = 2.89$) than children ($M = 1.66$, $SD = 2.27$). The Center for Youth Wellness classifies ACE scores of greater than or equal to four as High ACEs. In this sample, 28.2% of mothers ($n = 35$) and 15.3% of children ($n = 19$) had ACE scores of four or greater.

A one-way ANOVA was conducted to investigate the relationship between demographic characteristics and maternal and child ACE scores. Results are presented in Table 3 and Table 4, respectively.

With regard to ACE exposure, maternal ACE scores differed significantly by participant race ($F[5, 118] = 2.300$, $p = .049$), though post-hoc analyses to determine specific differences between categories could not be conducted because the categories of *Multiracial* and *Other* had two or fewer participants. Maternal education level was significantly associated with maternal ACE exposure ($F[2, 121] = 3.523$, $p = .032$). A post-hoc Tukey test indicated that there was an increase in ACE exposure among mothers reporting that they had attained a high school diploma ($M = 4.54$, $SD = 4.719$) when compared to mothers reporting that they had attained a graduate or professional degree ($M = 2.25$, $SD = 2.374$), a mean increase of 2.284, 95% CI [.23, 4.33], which was statistically significant ($p = .025$). Maternal age was significantly associated with maternal ACE exposure in this sample ($F[2, 121] = 3.881$, $p = .023$), with mothers over the age of 40 ($M = 1.77$, $SD = 2.065$) differing from mothers between the ages of 30 to 39 years ($M = 3.13$, $SD = 3.117$) reporting a mean increase of 1.354 ACEs, 95% CI [.12, 2.59], $p = .028$. Household income did not significantly predict maternal ACE exposure in this sample ($F[7, 116] = 1.779$, $p = .098$).

Table 3

Relationship Between Demographic Characteristics and Maternal Adverse Childhood Experience (ACE) Scores

Demographic variable	*df*	*F*	*p*
Household income	116	1.799	.098
Race	118	2.300	.049*
Education level	121	3.532	.032*

*$p < .001$

Table 4

Relationship Between Demographic Characteristics and Child Adverse Childhood Experience (ACE) Scores

Demographic variable	*df*	*F*	*p*
Adoptive/foster placement	122	-.506	.001*
Maternal education level	121	1.775	.174
Household income	116	1.688	.119
Maternal race/ ethnicity	118	1.635	.156
Child race/ ethnicity	118	.919	.471
Maternal age	121	.422	.657

*$p < .001$

Children's ACE scores did not differ significantly by child race/ethnicity ($F[5, 118] = .919$, $p = .471$), mother's age ($F[2, 121] = .422$, $p = .657$), maternal education level ($F[2, 121] = 1.775$, $p = 1.74$), or household income ($F[7, 116] = 1.688$, $p = .119$). A Pearson correlation between child age and ACE exposure yielded nonsignificant results $r(122) = .132$, $p = .143$. Children who had been adopted or were living in foster/guardianship placements had significantly higher ACE exposure ($M = 5.00$, $SD = 3.536$) than children living with their biological parents ($M = 1.27$, $SD = 1.705$), $t(122) = -6.483$, $p < .001$. No confounding variables were identified in the analyses of either maternal or child ACEs in this study.

Discussion

In this study, maternal and child ACE scores were found to be significantly associated. This is consistent with data on maternal and child ACE associations in mother-child dyads of children with typical hearing (Randall et al., 2015) but had not yet been substantiated in the literature on mothers and their children with hearing loss. The fact that mothers' ACE exposure significantly predicts ACE exposure in children with hearing loss is a novel finding of this investigation.

Adverse Childhood Experiences (ACEs)

Overall, the participants in this study reported levels of ACE exposure greater than previous research has indicated are prevalent in the general population. In their groundbreaking and wide-ranging ACE investigation with nearly 10,000 participants, Felitti et al. (1998) found that 52% of the adults surveyed reported having experienced at least one ACE, and 6.2% reported four or more. Later studies, such as Merrick et al. (2019) found that 15.6% of adults surveyed

reported four or more ACEs. Among children, Ager (2013) reported that 48% of children in the United States report at least one ACE, and Bethell et al. (2014) found that 22.6% of children in the United States have been exposed to two ACEs or more. In the present investigation, 28.2% of mothers (and 15.3% of children) fell into the high ACEs (ACE exposure ≥ 4) category. The unusually elevated ACE exposure in this sample may be due to several factors. The ACE questionnaire used in Felitti et al.'s (1998) original study included fewer ACEs than the CYW ACE-Q instrument used in the present investigation. Participant self-selection cannot be discounted. Perhaps mothers who felt strongly about the study topic of adverse childhood experiences were more likely to enroll and participate in this investigation. Likewise, an unusually high proportion of children in this study were reported to have been adopted or be living in foster/guardianship placements, placing them in a higher risk category for ACEs than children living with their biological mothers.

ACE exposure among mothers and children in this sample was significantly correlated, a finding in line with previous investigations. Randall et al. (2015) found a significant correlation between maternal and child ACE scores in dyads with hearing mothers and hearing children. This study substantiated that result among children with hearing loss and their mothers, the majority of whom reported typical hearing.

Mothers' race/ethnicity and level of formal education were found to be significantly associated with ACE exposure. In this sample, mothers who reported their race/ethnicity as White/Caucasian and mothers reporting higher levels of formal education had significantly lower levels of ACE exposure. Felitti et al. (1998) found that Asian participants were less likely to have high levels of ACE exposure, differing from the findings in the present investigation. However, other studies (Maguire-Jack et al., 2020; Vásquez et al., 2019) have had White/Caucasian participants report lower levels of ACE exposure, similar to this study. Felitti et al. (1998) found that participants who reported having attained a college degree were significantly less likely ($p < .001$) to report high levels of ACE exposure. Household income was not found to be predictive of maternal or child ACE exposure, a finding somewhat in line with the research of Halfon et al. (2017), which concluded that, although the proportion of children experiencing high ACEs increased as income decreased, "higher income was not necessarily found to be a protective factor against ACEs" (p. S70).

The only significant demographic factor measured in this study affecting child ACE exposure was the child's adoption status. Children living with adoptive or foster/guardian mothers reported significantly higher numbers of ACEs than peers living with their biological mothers. Other studies (Anthony et al., 2019; Turney & Wildeman, 2017) of children living in adoptive and foster/guardianship placements have similar findings.

Limitations

The demographics of the participants in this study differed from the population at large in several notable ways. Overall, the sample had a higher percentage of people who were white/Caucasian, had higher income levels, and had attained higher levels of formal education than the United States population as a whole. It is widely accepted that approximately 40% of children with hearing loss have additional disabilities (Holden-Pitt & Diaz, 1998; Picard, 2004), however the percentage of children with additional disabilities in this study (32%) is slightly lower. Likewise, both mothers and children in this study reported rates of ACE exposure greater than those found in previous studies of the general population (Felitti et al., 1998). Self-selection effects among the participant pool cannot be discounted as a potentially significant source in the lack of association between independent variables and language outcomes in this study.

Family income, absence of additional disabilities, and higher levels of maternal education have been established in the literature to be strongly correlated with improved language outcomes for children with hearing loss (Calderon, 2000; Sarant et al., 2009; Yoshinaga-Itano et al., 2017). Other studies have demonstrated robust associations between early identification, early hearing technology use, and early intervention and child language outcomes (Fulcher et al., 2012; Holzinger et al., 2011; Tomblin et al., 2015). Results from this sample did not concur, likely due to the size of this sample and self-selection effects among participants, not the credibility of earlier studies on the topic.

Although self-report measures of past experiences, particularly those from an adult's recollections of childhood, may be subject to scrutiny, Hardt and Rutter's (2004) meta-analysis of adult reports of childhood trauma found that adults' retrospective recollections of childhood trauma were much more predisposed to false negatives than false positives (if anything, people tend to underreport childhood trauma), and concluded that, although there was inherent bias in self-reporting measures, "such bias is not sufficiently great to invalidate retrospective case-control studies of major adversities of an easily-defined kind" (p. 260). Similarly, in their assessment of the correlation between clinical interview and self-report of childhood traumatic experiences among adults, Bifulco et al. (2005) reported satisfactory reliability and validity when comparing the parallel interview and self-report instruments. Research has also confirmed the reliability of parent reports on children's behavior, mental health, and other ACE-related factors (Bishop et al., 2003; Nauta et al., 2004; Oh et al., 2018; Theunissen et al., 1998). An additional limitation is that the children in this study were not asked to complete their own ACE questionnaires, even though some of them would likely have possessed the language and literacy skills to do so, particularly if aided by an impartial third party. Thus, although parent reports are generally considered valid and reliable measures of children's health and behavior, an investigation of the potential differences between parent-reported and self-reported ACE scores in this population would be of interest for future investigations.

Future Directions

Given the dearth of research on ACE exposure in the population of children with hearing loss, this study produced a notable addition to the literature by establishing, in this sample, a significant correlation for maternal and child ACEs for children with hearing loss, which is in line with findings on hearing mother-child dyads (Randall et al., 2015). The connection between maternal and child ACE exposure in this population suggests that ACE exposure should be viewed as a relevant aspect of children's and families' case histories upon enrollment in intervention services for childhood hearing loss. Given that maternal ACEs have the potential to negatively affect children's physical and psychosocial development (Racine et al., 2018), and children's ACE exposure has been linked with negative academic and developmental outcomes (Blodgett & Lanigan, 2018), professionals in the field of hearing loss would be wise to consider ACEs as another risk factor among those more commonly assessed during intake (e.g., premature birth, exposure to ototoxic drugs,

hyperbilirubinemia, etc.). Attention to trauma-informed care may have the potential to improve outcomes for children with hearing loss.

It is the hope of this researcher that the present investigation will raise awareness of the link between maternal and child ACE exposure among all stakeholders (e.g., teachers of the deaf, audiologists, speech-language pathologists, pediatricians, social workers, DHH adult mentors, early interventionists, policy makers, and others) serving children with hearing loss and their families. Incorporating training on trauma-informed care into family education and professional preparation programs and ongoing professional development initiatives may represent a positive first step in this direction.

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Appendix A

Center for Youth Wellness Adverse Childhood Experiences Questionnaire (CYW ACE-Q; Burke Harris & Renschler, 2015)

Count the number of statements that are things your child has experienced in his/her lifetime and write the TOTAL NUMBER below.

You DO NOT need to indicate which events your child has experienced.

- Your child's parents or guardians were separated or divorced
- Your child lived with a household member who served time in jail or prison
- Your child lived with a household member who was depressed, mentally ill, or attempted suicide
- Your child saw or heard household members hurt or threaten to hurt each other
- A household member swore at, insulted, humiliated, or put your child down in a way that scared your child OR a household member acted in a way that made your child afraid he/she might be physically hurt
- Someone touched your child's private parts (genitals) or asked your child to touch their private parts (genitals) in a sexual way
- More than once, your child went without food, clothing, a place to live, or had no one to protect him/her
- Someone pushed, grabbed, slapped, or threw something at your child OR your child was hit so hard that he/she was injured or had marks
- Your child lived with someone who had a problem with drinking or using drugs
- Your child often felt unsupported, unloved, and/or unprotected
- Your child was in foster care
- Your child experienced harassment or bullying at school
- Your child lived with a parent or guardian who died
- Your child was separated from his/her primary caregiver through deportation or immigration
- Your child had a serious medical procedure or life-threatening illness
- Your child often saw or heard violence in his/her neighborhood or his/her school neighborhood
- Your child was often treated badly because of his/her race, sexual orientation, place of birth, disability, or religion

Appendix B

Center for Youth Wellness Adverse Childhood Experiences Questionnaire (CYW ACE-Q; Burke Harris & Rentschler, 2015), Maternal Adaptation by Elizabeth A. Rosenzweig

How many of the following did you experience before the age of 18?

- Your parents or guardians were separated or divorced
- You lived with a household member who served time in jail or prison
- You lived with a household member who was depressed, mentally ill, or attempted suicide
- You saw or heard household members hurt or threaten to hurt each other
- A household member swore at, insulted, humiliated, or put you down in a way that scared you OR a household member acted in a way that made you afraid you might be physically hurt
- Someone touched your private parts (genitals) or asked you to touch their private parts (genitals) in a sexual way
- More than once, you went without food, clothing, a place to live, or had no one to protect you
- Someone pushed, grabbed, slapped, or threw something at you OR you were hit so hard that you were injured or had marks
- You lived with someone who had a problem with drinking or using drugs
- You often felt unsupported, unloved, and/or unprotected
- You were in foster care
- You experienced harassment or bullying at school
- You lived with a parent or guardian who died
- You were separated from your primary caregiver through deportation or immigration
- You had a serious medical procedure or life-threatening illness
- You often saw or heard violence in your neighborhood or your school neighborhood
- You were often treated badly because of your race, sexual orientation, place of birth, disability, or religion

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