Comparisons of Social Competence in Young Children With and Without Hearing Loss: A Dynamic Systems Framework

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This study compared levels of social competence and language development in 74 young children with hearing loss and 38 hearing peers aged 2.5–5.3 years. This study was the first to examine the relationship between oral language and social competence using a dynamic systems framework in children with and without hearing loss. We hypothesized that, due to deficits in oral language, children who were deaf would display lower levels of social competence than their hearing peers. Furthermore, language age would predict social competence scores. Social competence was measured with a general and deaf-specific measure. Results showed that children with hearing loss performed significantly worse than hearing peers on the general measure but better than the norms on the deaf-specific measure. Controlling for maternal education and income, regression analyses indicated that hearing status and language age predicted social competence in both groups. Among children with hearing loss, correlations were also found between age at diagnosis, age at amplification, and two of the general social competence measures. Results supported our hypothesis that deficits in language would have cascading negative effects on the development of social competence in young deaf children. Development of early intervention programs that target both language and social skills are needed for this population.

Social competence is a broad construct that reflects a child's ability to interact effectively with those in the environment, such as peers, family members, and other adults (Gresham & Elliott, 1990). It is well established that young children's social interactions play a significant role in their emotional and behavioral development (Deater-Deckard, 2001; Hay, Payne, & Chadwick, 2004; Ladd, 2005). Furthermore, positive peer relationships among preschoolers have been associated with better behavioral, emotional, and academic outcomes in the future (McElwain & Volling, 2005). For children with hearing loss, deficits in oral or sign language, which precede the emergence of social skills, create a perturbation in the developing system that may be associated with delays in social competence (Barnett, Gustafsson, Deng, Mills-Koonce, & Cox, 2012). This hypothesis is supported by dynamic systems theory, which postulates interconnections among different areas of development, with deficits in one area leading to cascading effects in others (Rubin, Burgess, Kennedy, & Stewart, 2003; Smith & Thelen, 1993; Thelen & Smith, 1994). Thus, children with hearing loss, who are delayed in oral language, may also evidence delays in social competence (Tasker, Nowakowski, & Schmidt, 2010). Given the importance of social interactions on young children's development, earlier identification and remediation of potential delays is warranted. The purpose of this study was to compare social competence in preschoolers with and without hearing loss in relation to their language development.

Social competence is a broad construct that reflects a child's ability to interact effectively with those in the environment, such as peers, family members, and other adults (Waters & Sroufe, 1983). It has been more narrowly defined as the ability to spontaneously utilize social skills in a flexible and adaptive manner (Lillvist, Sandberg, Björck-Akesson, & Granlund, 2009), with an assessment of both macro (e.g., engaging in conversation, perspective taking) and micro skills (e.g., eye contact, requesting help)—Gresham and Elliott (1990). It also includes the ability to express emotions appropriately and exhibit self-control (Gresham & Elliott, 1990; Hogan, Scott, & Bauer, 1992).
Thus, social competence is fundamental to the formation and maintenance of positive relationships.

For children with hearing loss, little attention has been paid to how their language delays affect the development of social competence. In addition, few studies have measured social competence in preschoolers (Tasker et al., 2010), a critical period during which social skills emerge (Semrud-Clikeman, 2007). Although older studies of social competence in preschool deaf children exist (Arnold & Tremblay, 1979; Cappelli, Daniels, Durieux-Smith, McGrath, & Neuss, 1995), they do not reflect advances in childhood deafness, such as implementation of universal newborn hearing screening or the development of cochlear implant (CI) technologies (Halpin, Smith, Widen, & Chertoff, 2010; Tomblin, Spencer, Flock, Tyler, & Gantz, 1999). Thus, little is currently known about how hearing loss affects the development of social competence in preschoolers with severe-to-profound hearing loss.

### Applications of Dynamic Systems Theory to Communicative and Social Development

Dynamic systems theory highlights the complexity of development as it occurs across multiple domains. Development in one area depends on development in others, as children engage in specific activities across contexts (Smith & Thelen, 1993). This theory also posits that distal factors, such as social and economic factors (e.g., race/ethnicity, family income) may affect these developmental processes. Importantly, dynamic systems theory has primarily been used to evaluate communicative, cognitive, and motor development (Spencer, Austin, & Schutte, 2012; Spencer, Perone, & Buss, 2011; Thelen & Smith, 1994), with few studies applying this theory to social and linguistic development (Barnett et al., 2012; Steenbeek & Van Geert, 1999).

Language and social competence undergo significant, interrelated changes during the second and third years of life, as children’s skills improve and become more integrated (Barnett et al., 2012; Longoria, Page, Hubbs-Tait, & Kennison, 2009). Two-year-olds experience rapid growth in language skills, honing their expressive and receptive language, particularly through parent–child interactions (Barnett et al., 2012; Bornstein, Hahn, & Haynes, 2004). This early communication is utilized primarily within social contexts, as children engage others, make requests, and begin to regulate their behavior (Vygotsky, 1978).

Language is a social tool that provides opportunities to improve social competence (Barnett et al., 2012; Hay et al., 2004). Thus, we hypothesized that deaf children with language delays would experience fewer social interactions and, in turn, evidence deficits in social competence.

Beyond understanding the interconnections among domains, dynamic systems theory also posits that the emergence of new behaviors provides an opportunity to study the underlying processes that create change (Thelen & Smith, 1994). The auditory deprivation experienced by children with severe-to-profound hearing losses provides a “window” into how this disruption affects emerging language and social skills. During development, as new skills appear or undergo significant growth (e.g., language and communicative expression), the system loses balance. This loss of stability causes previously established behaviors to shift and temporarily disrupts coordination among key behaviors (Parladé & Iverson, 2011). The system reorganizes while searching for new patterns of stability and thus, a disruption in one part of the system, such as oral communication, may profoundly alter the development of another area, such as social skills. For example, as preschoolers spend more time interacting with peers, this shift triggers rapid growth in language abilities and social competence as they adjust to new demands in their environment. This provides an opportunity to examine processes of change and their potential effects on social competence (Semrud-Clikeman, 2007).

### Development of Social Competence in Children With Hearing Loss

Hearing preschoolers experience rapid growth in social competence as they learn to play with others, regulate their emotions, and negotiate conflicts—all of which require language (Denham, von Salisch, Othof, Kochanoff, & Caverly, 2002; Semrud-Clikeman, 2007). However, few studies have evaluated social competence in deaf children during this critical period of development. Furthermore, the extant literature is inconclusive because of inconsistencies in methods and results. Previous studies of deaf preschoolers have measured social competence using sociometric ratings, videotaped interactions, and child or parent-reported questionnaires, as described below. These differences in measurement have led to discrepant findings that are difficult to reconcile. In addition, no studies have used teacher report, despite the fact that preschoolers primarily engage in social interactions while in school. This study provided an additional perspective from which to observe social competence in young, deaf children.

In the only two published studies which included deaf preschoolers, mixed results were found. Brown, Bortoli, Remine, and Othman (2008) coded the videotaped peer interactions of deaf and hearing children (total N = 20) in an inclusion preschool and found that deaf children scored significantly lower on the “interactive” variable but were not significantly different than hearing peers on the social competence composite. The “interactive” variable assessed whether a child was within 2 m of another child, with whom they interacted either verbally or nonverbally, whereas the other two scales in the composite measured whether the child was simply “observing” others. In contrast to videotaped interactions, Tasker and colleagues (2010) measured social competence using parent report on the Adaptive Social Behavioral Inventory (Hogan et al., 1992) in profoundly deaf toddlers (M age = 26.37 months). Their results indicated significant differences between the deaf and hearing groups (total N = 52) on the “Express” subscale. This subscale measured the child’s ability to initiate and engage in social behaviors and express emotions appropriately. No significant differences were found between groups on the “Comply” subscale, which measured the ability to cooperate and respond appropriately, or the “Disrupt” subscale, which measured the frequency with which the child engages in negative, but “age-normative behaviors” (Tasker et al., 2010, p. 521).

In a study of mainstreamed school-age children (Cappelli et al., 1995), sociometric ratings and child self-report on the Self-Perception Profile for Children (Harter, 1985) indicated that the children with (N = 23) and without (N = 23) hearing loss differed significantly on the sociometric ratings but not on the Harter scale. However, it is important to note that there is a high degree of overlap in these constructs, given that a child’s sense of self is related to their social interactions. Children with hearing loss were more likely to be rejected by their peers and received lower likeability ratings. Although these studies tended to suggest there are deficits in social competence when comparing deaf and hearing children, they were limited by small, convenience
samples and there was also minimal information on race or ethnicity.

More recently, studies have examined social competence in children following cochlear implantation. Cochlear implants are surgically implanted electronic devices that provide sound to a child who is profoundly or severely deaf, greatly improving language abilities (Geers, Nicholas, & Sedey, 2003; Niparko et al., 2010) and potentially facilitating the development of social competence. van Eldik, Treffers, Veerman, and Verhulst (2004) measured social functioning using parent report on the Child Behavior Checklist (CBCL; Achenbach, McConaughy, & Howell, 1987) and found the rate of psychosocial difficulties (e.g., social problems, aggressive behaviors, anxious/depressed symptoms) was 2.6 times higher in the deaf than normative hearing group. Specifically, deaf children scored lower (worse) on the Social Problems Scale than hearing children. However, the CBCL was not designed specifically to measure social functioning and thus has limited coverage of this construct.

In a large study of 181 children (aged 8–9 years) with cochlear implants, parents reported on children’s social competence using a deaf-specific measure (Nicholas & Geers, 2003). They found higher levels of social competence on the Social-Emotional Assessment Inventory (SEAI; Meadow-Orlans, 1983) in the cochlear implant sample when compared to the deaf norms. Findings from this study should be interpreted with caution because the SEAI was published in 1983, prior to advancements in the treatment of childhood deafness and cochlear implantation. However, the SEAI is the only validated, deaf-specific measure of social competence available and remains widely used by clinicians and audiologists today. In our study, we used the SEAI and compared it to a social competence measure developed specifically for preschool-age children.

In sum, prior studies of social competence in deaf children have generally found delays when using measures developed for or normed with hearing children. Similarly, most studies have reported significant deficits in social competence among deaf children using coded interactions, sociometric data, and parent report measures. However, these studies have analyzed small samples with primarily Caucasian children and, thus, are not representative of the deaf population. This study aimed to address this question in a large, multisite, nationally representative sample of young deaf children prior to cochlear implantation, with attention to recruiting families who varied on race and ethnicity.

To date, no studies have measured social competence in deaf children from the teacher’s perspective, despite the fact that they are in an excellent position to evaluate the development of social skills and peer interactions, and potentially facilitating the development of social competence in deaf children (van Eldik et al., 2004). van Eldik, Treffers, Veerman, and Verhulst (2004) measured social functioning using parent report on the Child Behavior Checklist (CBCL; Achenbach, McConaughy, & Howell, 1987) and found the rate of psychosocial difficulties (e.g., social problems, aggressive behaviors, anxious/depressed symptoms) was 2.6 times higher in the deaf than normative hearing group. Specifically, deaf children scored lower (worse) on the Social Problems Scale than hearing children. However, the CBCL was not designed specifically to measure social functioning and thus has limited coverage of this construct.

Aims of Study

This study utilized data from a diverse, nationally representative sample at six implant centers (Childhood Development after Cochlear Implantation [CDaCI]; Fink et al., 2007; Niparko et al., 2010), making it the largest, youngest cohort of children receiving CIs and children with normal hearing. An age-matched hearing sample (n = 97) was recruited from two university preschools. This study utilized a subsample of children 2.5 years of age and older prior to implantation (N = 112). This comprehensive, multisite dataset provided an opportunity to test our hypotheses within a large, diverse sample of deaf children—avoiding the limitations of previous research.

This study had three primary aims. The first was to compare social competence in deaf and hearing preschoolers at baseline prior to implantation. It was hypothesized that deaf children would display deficits in social competence compared to hearing children on the generic measure. Our second aim was to evaluate the deaf children’s social competence before cochlear implant using a deaf-specific measure, which has normative data. We expected the deaf sample to have higher levels of social competence than the deaf norms because of recent advances in identification and treatment of childhood deafness (e.g., universal newborn hearing screening). The third aim was to evaluate the relationship between oral language and social competence. It was hypothesized that hearing status would be significantly related to language age in both samples and would predict levels of social competence.

Method

Inclusion criteria for participants in the CDaCI study were the following: (a) children ages 5 years or younger, (b) severe-to-profound sensorineural hearing loss, and (c) parents committed to educating the child in spoken English. Exclusion criteria included significant cognitive impairment (i.e., a Bayley Mental or Motor score of less than 70 or Leiter International Performance Scale—Revised score of less than 66). To facilitate generalizability of these findings to a broader population of children receiving CIs, we included children with scores higher than 70 and 66, respectively, on our cognitive measures. Participants in the hearing group were age matched to the deaf group. All participants were assessed at baseline (prior to implantation for the deaf group).

Our sample was restricted to children 2.5 years of age or older at baseline, prior to implant surgery. We selected this subsample because social competence is a skill that develops later (after age 2) and there is no normative data available on these measures for younger children. Institutional review boards at all centers and preschools approved the study protocol.

Participants

The subsample consisted of 74 deaf and 38 hearing children (N = 112). Comparisons of demographic data between the deaf and hearing cohorts indicated these groups were similar on child age, gender, and ethnic composition. However, the deaf sample had a higher proportion of Hispanic children (deaf = 21.6%, hearing = 15.8%), lower mean parental education, and lower mean income (see Table 1) than the hearing group. To account for these differences, all analyses controlled for maternal education and income.

The mean age of deaf children was 40.9 months (SD = 8.8 months) and the mean age of the hearing sample was 40.4
months (SD = 9.6 months). Among the deaf sample, age of onset of hearing loss varied between birth and 44 months (M = 5.5 months, SD = 10.8 months), and all children were severely to profoundly deaf. Hearing loss was diagnosed at a mean age of 16.6 months (SD = 12.3) and average length of hearing aid use before implantation was 20.0 months (SD = 11.9). For a majority of deaf children in this sample (67.6%), onset of hearing loss was at birth.

Procedures

After an initial medical screening in the deaf sample, a baseline assessment was scheduled prior to implant surgery, at which time all preimplant data were collected. Assessments were conducted by speech and language pathologists either at the child’s implant center or, in the case of the hearing sample, at the child’s preschool. The assessment was typically conducted during two half-day appointments to minimize fatigue for the child and family. During the first day, parents provided demographic, audiological, medical, and educational information, and children were assessed with language measures, cognitive tests, and an audiological exam. The social competence measures were given to parents, who delivered them to their child’s preschool teacher. Teachers were provided with a small incentive (e.g., $10 Starbucks gift card) to complete these measures and mail them back to the Data Coordinating Center. Parents in both the deaf and hearing group received a $100 stipend annually, travel funds if required, and extended warranties for the implants as reimbursement for their time and effort.

Measures

Social competence

Social competence and behavior evaluation.

Preschool teachers rated children’s social competence in the classroom using the Social Competence and Behavior Evaluation-Preschool Edition (SCBE; LaFreniere & Dumas, 1995). The SCBE
measures social competence, internalizing, and externalizing behaviors and was developed and normed on 979 hearing children aged 30–78 months. It contains 80 questions, 40 of which comprise the Social Competence composite score, with the remaining 40 questions loading on the Externalizing Problems and Internalizing Problems composites. The three composite scales are combined into an overall General Adaptability score. Only scores on the Social Competence and General Adaptability scales were examined in this study. Individual items consisted of statements rated on a 6-point Likert scale ranging from “Never” to “Always,” reflecting how well the statement applies to that child. Sample items include “Tolerates interruptions and disturbances;” “Self-confident;” and “Does not respond to other children’s invitations to play.” Gender-normed t scores are provided, with higher scores indicating “better social functioning.” T scores of 37 and below are considered to be in the clinically significant range. This measure demonstrated strong psychometric properties during standardization, with interrater reliability across teachers ranging from .72 to .89 on the individual subscales. Internal consistency, as measured by Cronbach’s alpha, ranged from .80 to .89 across individual scales in the normative sample (.89 on the Social Competence scale). For this study, the Social Competence scale was found to be highly reliable (40 items; α = .96).

Social-Emotional Assessment Inventory.
Teachers also rated social competence in the deaf group using the SEAI (Meadow-Orlans, 1983), a deaf-specific measure. Two versions of the measure exist: one for preschoolers and one for school-age children. This study utilized the preschool-age form, which consisted of 49 questions divided into four subscales: Social, Communicative Behaviors (18 items; e.g., Forms warm, close attachments to peers); Impulsive, Dominating Behaviors (16 items; e.g., Willing to take turns, Understands concept of turn taking); Developmental Lags (6 items; e.g., Feeds self adequately with fork/spoon); and Anxious, Compulsive Behaviors (6 items; e.g., Basically an anxious child; Nervous, worries about many things). The remaining three questions were specific to deafness. Items were rated on 4-point scale as “Very True,” “True,” “False,” or “Very False.” Scores are summed, divided by number of questions answered, and given a percentile rank to the nearest tenth. Higher scores indicate better levels of functioning. Scores in the 30th percentile or lower were considered “below average” and scores in the 80th percentile and above were considered “above average.” Age and gender-specific norms are provided for each subscale. Normative data were drawn from preschool programs serving 857 deaf children aged 36–83 months across the United States (Meadow-Orlans, 1983). Although we included deaf children who were 2.5 years of age, there were only 17 children below the age of 36 months. Test-retest reliability for individual scales across 4 weeks at four different schools ranged from .25 to .95, with overall test-retest reliability in the acceptable range (r = .75). Some evidence of convergent validity was obtained by asking teachers several general questions, which were then correlated with the SEAI subscales. We found adequate internal consistency in this sample, with Cronbach’s alphas of .76 to .91 across subscales.

Language

Language age.
Two language measures, described below, provided age-equivalent scores based on their respective normative samples. This provided a common metric that was used to combine data across tests to create a composite variable of language functioning. Only scores within the valid range for each measure were used in these analyses. As suggested by each manual, scores either at the floor or ceiling of the measure were excluded (n = 5). In this study, language age refers to the composite age-equivalent score from the two language measures. Both language measures used in this study have been used in deaf and hard of hearing samples (Svirsky, Robbins, Kirk, Pisoni, & Miyamoto, 2000; Thal, Desjardins, & Eisenberg, 2007; Toe & Paatsch, 2010).

Reynell Developmental Language Scale.
The Reynell Developmental Language Scale (RDL; Reynell & Gruber, 1990) is a commonly used language assessment for children aged 1–7. The test consists of two subscales: the Verbal Comprehension Scale and Expressive Language scale. Both subscales display acceptable split-half reliability coefficients across ages (.74–.93).

MacArthur–Bates Communicative Development Inventories.
The MacArthur–Bates Communicative Development Inventories (CDI; Fenson et al., 1993) is a widely used parent report measure of children’s language. This study utilized Section I (words) of the Words and Sentences inventory, designed to assess the vocabulary of children aged 16–30 months. This inventory has been previously used with preschool children who have language impairments (Thal, O’Hanlon, Clemons, & Fraid, 1999). Words were only recorded if they were understood or spoken orally. The Words inventory demonstrated strong internal consistency (α = .96) in the standardization sample.

Analytic Approach
To test our hypotheses, three analytic approaches were utilized. First, descriptive statistics and correlations were conducted on the medical and demographic variables (e.g., maternal education, racial/ethnic minority), language age, and the two social competence scales (i.e., Social Competence and General Adaptability). Next, we compared the deaf and hearing groups on measures of social competence using a series of independent t tests. Chi-square analyses were also utilized to compare the proportion of children in each group who scored above the clinical cutoffs. Second, we compared deaf children’s social competence to the normative sample on the SEAI using descriptive statistics. Finally, we examined the relationships among hearing status, language age, and social competence using correlations and path analyses. All analyses were conducted using the SPSS Statistics 21 software.

Results

Comparisons of Deaf and Hearing Children on Social Competence
To assess the potential impact of sociodemographic variables on social competence, simple correlations between maternal education, family income, and race/ethnicity and the two outcome measures were computed separately for the deaf and hearing groups. No statistically significant associations were found. However, given that the two groups differed, on average, on these variables, we controlled for them in later analyses. Means, standard deviations, and correlations among these measures are reported in Table 2. Children in the deaf group had, on average, a significantly lower Language Age compared to their hearing peers (deaf = 17.7 months [SD = 7.1], hearing = 37.6 months [SD =
Language Age was significantly correlated with Social Competence and General Adaptability in both groups, with higher language age associated with better social functioning. Parents of children in the deaf versus hearing group also had significantly lower maternal income (t(109) = 2.91, p < .05, 95% CI = [0.20, 1.08]) and maternal education (t(109) = 3.25, p < .05, 95% CI = [0.25, 1.03]). Among the deaf children, age at diagnosis and age at amplification were also significantly correlated with the two SCBE scales, with younger age associated with better social competence (see Table 2).

The first analysis compared social competence in the deaf and hearing groups on the SCBE. We hypothesized that deaf children would display lower levels of social competence than their hearing peers. Strong support for this hypothesis was found. A series of t tests indicated that children in the deaf group scored lower than children in the hearing group on the Social Competence (t(84) = 3.13, p < .05, 95% CI = [2.57, 11.52]) and General Adaptability scales (t(84) = 2.97, p < .05, d = 0.66, 95% CI = [2.22, 11.28]). Figure 1 presents the group comparisons using mean t scores on Social Competence and General Adaptability. To assess the clinical significance of these social deficits, analyses were conducted to examine the percentage of children in both groups who fell within the clinical range. Mixed evidence was found. The proportion of deaf versus hearing children in the clinical range was not significantly different for the Social Competence scale (deaf = 21.0%, hearing = 6.9%; χ²(2, N = 86) = 2.12, p > .05, 95% CI = [0.02, 0.35]), but was significantly lower for the General Adaptability scale, (deaf = 21.1%, hearing = 3.4%; χ²(2, N = 86) = 4.64, p < .05, 95% CI = [0.02, 0.39]). More children in the deaf group versus hearing group scored in the clinical range on this global measure of functioning.

Comparisons of Social Competence in the Deaf Sample in Relation to Deaf Norms

To test the hypothesis that our deaf sample would display higher levels of social competence than the deaf norms on the SEAI, we examined the proportion of children in our sample who performed in the “above average” range (80th percentile or greater)—see Table 3. Our deaf sample scored in the above average range on two of the three SEAI scales we targeted: Social Communicative Behaviors (37.7% vs. expected 20%) and the Anxious, Compulsive Behaviors (48.9% vs. expected 20%). On the Impulsive, Dominating Behaviors scale, 32.6% (again vs. expected 20%) of our deaf sample scored in the above average range. Note that age at diagnosis, age at amplification and language age were not significantly correlated with any of the SEAI scales (see Table 4).

Predicting Social Competence From Language Age

To test the hypothesis that social competence is predicted by language age, path analyses were conducted (Figure 2). Neither Maternal Education (β = .01, t(82) = 0.6, p > .05) nor parental income (β = −.19, t(82) = 1.76, p > .05) significantly predicted social competence. However, given that there were significant differences between groups, these factors were controlled. After controlling for these demographic variables, hearing status directly predicted Social Competence and General Adaptability (Social Competence: β = −.32, F(3,81) = −2.84, p < .05, d = 0.63; General Adaptability: β = −.28, F(3,81) = 2.50, p < .05, d = 0.55). Deaf children scored significantly lower on Language Age. Language age, significantly predicted hearing status (β = −.78, F(3,101) = −11.70, p < .05, d = 2.32). Language Age also significantly predicted Social Competence and General Adaptability (Social Competence: β = .49, F(3,76) = 4.26, p < .05, d = 0.76; General Adaptability: β = .43, F(3,76) = 3.65, p < .05, d = 0.83), accounting for 18.6% and 14.5% of the variance in Social Competence and General Adaptability, respectively. When controlling for Language Age, Hearing Status no longer significantly predicted Social Competence (β = .09, F(4,75) = .61, p > .05) or General Adaptability (β = .09, F(4,75) = 2.95, p > .05). Thus, Language Age fully mediated the relationship between Hearing Status and Social Competence (See Figure 2). Note also that these analyses were cross-sectional and thus, do not address the directionality of these findings.

Discussion

This study evaluated the largest and youngest cohort of CI candidates to date and examined relationships among childhood deafness, oral language abilities, and social competence.
Table 2. Bivariate correlations between Audiological Variables and SCBE subscales by hearing status

<table>
<thead>
<tr>
<th></th>
<th>Deaf group 1</th>
<th>Deaf group 2</th>
<th>Deaf group 3</th>
<th>Deaf group 4</th>
<th>Deaf group 5</th>
<th>Deaf group 6</th>
<th>Hearing group 1</th>
<th>Hearing group 2</th>
<th>Hearing group 3</th>
<th>Hearing group 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Race/ethnicity</td>
<td>1</td>
<td>.16</td>
<td>.21</td>
<td>.18</td>
<td>.19</td>
<td>.15</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<tr>
<td>2. Maternal education</td>
<td>.30*</td>
<td>.67</td>
<td>.36*</td>
<td>.28*</td>
<td>.28</td>
<td>.19</td>
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<td>3. Parental income</td>
<td>−.10</td>
<td>.01</td>
<td>−.12</td>
<td>.90*</td>
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<td>.10</td>
<td>−.20</td>
<td>.20</td>
<td>.10</td>
<td>.10</td>
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<td>4. Language age</td>
<td>−.21</td>
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<td>1</td>
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<td>5. Age at diagnosis</td>
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<td>.35*</td>
<td>1</td>
<td>.28</td>
<td>.15</td>
<td>−.20</td>
<td>.20</td>
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<td>6. Age at amplification</td>
<td>.08</td>
<td>.10</td>
<td>.05</td>
<td>.12</td>
<td>.95*</td>
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<td>.02</td>
<td>.02</td>
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<td>.02</td>
</tr>
<tr>
<td>7. Social Competence</td>
<td>.19</td>
<td>.28*</td>
<td>.32*</td>
<td>−.28*</td>
<td>−.29*</td>
<td>1</td>
<td>.15</td>
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<td>.15</td>
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<td>8. General Adaptability</td>
<td>.28</td>
<td>−.02</td>
<td>.08</td>
<td>.28*</td>
<td>−.30</td>
<td>−.35*</td>
<td>.92*</td>
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<td>M (SD)</td>
<td>N/A*</td>
<td>N/A*</td>
<td>N/A</td>
<td>17.7 (7.1)*</td>
<td>17.7 (7.1)</td>
<td>20.0 (11.9)</td>
<td>46.2 (9.7)*</td>
<td>46.0 (9.6)*</td>
<td>53.0 (10.5)*</td>
<td>53.0 (10.5)*</td>
</tr>
</tbody>
</table>

Note. "Significant difference between deaf and hearing groups. *p < .05.

Table 3. Percentage of children with hearing loss in each category on the SEAI scales

<table>
<thead>
<tr>
<th>SEAI scale</th>
<th>Below average (&lt;30th percentile)</th>
<th>Average (30–80th percentile)</th>
<th>Above average (&gt;80th percentile)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sociable, communicative behaviors</td>
<td>13.2%</td>
<td>49.1%</td>
<td>37.7%</td>
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<tr>
<td>Impulsive, dominating behaviors</td>
<td>28.8%</td>
<td>38.6%</td>
<td>32.6%</td>
</tr>
<tr>
<td>Anxious, compulsive behaviors</td>
<td>19.1%</td>
<td>32.0%</td>
<td>48.9%</td>
</tr>
</tbody>
</table>

Although other studies have evaluated social competence in deaf children (Brown et al., 2008; Tasker et al., 2010), this was the first to utilize teacher data, which provided valuable insights into deaf children’s social interactions. Our results showed that young deaf children before cochlear implantation have significant deficits in social competence when compared to their age-matched, hearing peers. We also found that language age was significantly related to the development of social competence in both groups. However, given the cross-sectional nature of our data, we cannot determine causality.

These results supported dynamic systems theory, which proposes that deficits in one area of development have cascading effects on others (Thelen & Smith, 1994). Given the delays in language documented in deaf children, we expected that the emergence of social skills, which are strongly mediated by language abilities, would be delayed (Barnett et al., 2012; Hay et al., 2004; Niparko et al., 2010). Our findings were consistent with previous studies that have found deficits in the initiation and engagement of social behaviors among deaf children (Brown et al., 2008; Tasker et al., 2010). However, these studies relied on parental assessments of social functioning. In contrast, we utilized standardized teacher report measures, which reflected children’s social competence in a school context. Results showing that these young deaf children evidenced deficits in both of these social settings (i.e., home and school) indicate there is consistency across raters and highlight the importance of providing interventions to address these problems.

Although previous studies examined social skills prior to implantation, Martin, Bat-Chava, Lalwani, and Waltzman (2011) examined social skills in young, deaf children (M age = 5 years, 10 months) 1 year following cochlear implantation, using a Peer Entry Task. Observational coding of these peer interactions showed no significant differences between the deaf and hearing groups in these social behaviors (e.g., sharing, collaborative play), suggesting potentially positive effects of implantation. Furthermore, longer implant use was associated with better performance. Children who used their implants longer engaged in more interactive and collaborative play. Several studies have explored social behaviors in adolescents with CIs and hearing aids (Fellinger, Holzinger, Beitel, Laucht, & Goldberg, 2009; Fellinger, Holzinger, Sattel, Laucht, & Goldberg, 2009; Nunes, Pretzlik, & Olsson, 2001), however, more research is needed in this young age group.

The findings from our study also supported previous literature linking language and social competence in hearing children. Kaczmarek (2002) argued that oral language should be viewed as the gateway to social competence because it is the primary mechanism of social interactions. Our results indicated there was a stronger association between language age and social competence in the hearing versus deaf group. This was likely due to the limited distribution of language age scores in the deaf group, which attenuated the strength of this association.

Previous studies of hearing preschoolers have found significant correlations between language and social competence at 24 and 36 months of age (Barnett et al., 2012). Although deaf-specific studies have provided some evidence for delays in social competence (Brown et al., 2008; Tasker et al., 2010), none have directly examined this relationship to language among preschoolers. Therefore, there have been no opportunities to evaluate potential mechanisms that underlie the deficits in social competence among deaf children observed in prior studies. These studies were also limited by small samples with...
primarily Caucasian children and, thus, are not representative of the deaf population. In contrast, this study utilized a large, nationally representative sample (Wang, Carson, & Niparko, 2012), with an emphasis on the recruitment of underrepresented minorities.

Another limitation of previous research has been use of the SEAI (e.g., Nicholas & Geers, 2003). Many clinicians and audiologists rely on the SEAI, because it is the only validated, deaf-specific measure of social competence. However, our results indicated that the SEAI does not accurately measure social functioning in today’s deaf population. We identified three problems with the SEAI. First, the SEAI was normed in 1983 and thus, does not reflect current medical advances in childhood deafness. The normative sample is more than 25 years old and thus, does not take into account earlier diagnosis via newborn hearing screening and the benefits of cochlear implantation, which did not exist at that time (Bat-Chava, Martin, & Kosciw, 2005; Osberger, Maso, & Sam, 1993). Second, the SEAI did not demonstrate strong associations with key variables in this sample (e.g., age at diagnosis, age at amplification, language age). Third, it is not possible to obtain a standardized score (i.e., t scores or scaled scores) on this measure, making it difficult to identify those at clinical risk. Therefore, we recommend that a new social competence measure for children with hearing loss be developed.

Limitations and Future Directions

This study had several limitations. First, we presented comparisons of social competence at baseline for the deaf and hearing groups, which precludes an evaluation of causal effects, which requires longitudinal data. Second, this study focused only on the teacher’s perspective, using a measure that was designed specifically for the classroom context. Although it would be helpful to have multiple perspectives, we identified this as an important gap in the literature. Finally, we were not able to include school placement in the analyses because of missing data.

Despite these limitations, this study was the first to evaluate social competence in deaf and hearing preschoolers using teacher ratings. We found that these young, deaf children had delays in social competence in comparison to their hearing peers, and that these delays were strongly associated with language abilities. However, these differences were not observed on the deaf-specific measure, the SEAI, which appears to be outdated and in need of revision. These deficits point to the need for early intervention programs that target social skills in this population (Ladd, 2005; McElwain & Volling, 2005). As children are diagnosed and implanted at earlier ages, it is likely they will still need assistance in navigating their social environments at home, at school, and in the community (Quittner, Cejas, Barker, & Hoffman, 2014).

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Conflicts of Interest

Warranties on the implant devices used by children with implants in this study were discounted 50% by the Advanced Bionics Corporation, the Cochlear Corporation, and the MEDEL Corporation.

References

Deater-Deckard, K. (2001). Annotation: Recent research examining the role of peer relationships in the development of


