

**Social-emotional development in children who are deaf or hard of hearing**

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## **Abstract**

*Purpose:* The purpose of this study was to assess social emotional development (SED) in children who are deaf or hard of hearing (HOH). This research focused on three questions: 1) Do children who are deaf or HOH demonstrate delay in SED compared to typically hearing children; 2) Are there certain social emotional skills that the children have difficulty with; and 3) Are there differences in social emotional ability percentile ranks for children who are approximately 15 months versus when they are 31 months of age?

*Methods:* The Greenspan Social Emotional Growth Chart (GSEGC) was used to quantify SED in children who are deaf or HOH. 78 participants, ages 9 to 39 months, had completed GSEGCs. Of those participants, 55 completed the GSEGC at two different times, allowing for comparison between a mean age of 14.5 months and 31.5 months.

*Results:* In the younger group 28.2% and in the older group 21.1% of participants fell below the 10<sup>th</sup> percentile on the GSEGC; however, over an approximate 1-year time span, SED percentile ranks improved within this sample.

*Conclusions:* Children with hearing loss showed a delay in SED, although delays were less apparent over time. Social emotional skills that were most difficult were related to sound, attention getting, and the use/comprehension of language.

**Acronyms**

Acronym	Term
SED	Social emotional development
HOH	Hard of hearing
GSEGC	Greenspan Social Emotional Growth Chart
HA	Hearing Aid
CI	Cochlear Implant
NECAP	National Early Childhood Assessment Project

## **Introduction**

Social emotional development (SED) can be described as the acquisition of skills to express and manage emotions, as well as engage in relationships. The development of social skills impacts the complexity of a child's play, verbal productions, empathy, and reasoning (Greenspan, 2004). Early SED from birth to 6 months includes facial and bodily expressions like smiling, engaging in eye contact, and soothing oneself through activities like thumb sucking. Later social emotional skills include theory of mind and engaging in make-believe play.

Previous research has established that there are areas of development for which there are differences between children who are deaf or HOH versus those who are typically hearing. With differences in areas such as language development and neuroanatomical development (principally in the areas that are intended for auditory processing), this could potentially impact SED. Moeller (2007) found that children with hearing loss frequently fall one standard deviation or more below the mean on norms for parent-rated measures of social development. The differences between typically developing children and those who are deaf or HOH may be due to difficulties in the ability to listen and communicate (Stika et al., 2015).

This research focuses on SED in children who are deaf or HOH. Comparing the SED of children who are deaf or HOH and typically hearing children can help characterize the type and magnitude of SED difficulty experienced by children with hearing loss. This, in turn, may lead to additions or modifications to early intervention that can lead to a reduction of negative outcomes (Vaccari & Marschark, 1997).

## **Social emotional development (SED)**

### ***Social emotional development***

SED involves the acquisition of skills to express and manage emotions, including how to navigate personal relationships and how to explore emotions in different environments (Briggs et al., 2014). Part of SED also involves exploring how emotional information is processed in social situations. For example, if a child experiences a positive interaction while receiving information about a new object, they will react positively to the object, as opposed to reacting negatively if the introduction of the object was perceived as a negative experience (Varish et al., 2008).

SED can be an indicator of a child's willingness and readiness to learn, and it can be a predictor of a child needing more academic support (Denham, 2006). If children are experiencing age appropriate SED, they are typically more successful in adjusting to a school environment, making friends, and obtaining higher grades than children who are falling behind in SED (Denham, 2006). In children who are deaf or HOH, attributes of SED can provide insight regarding the ability to successfully form bonds with family and can foster a foundation for language development (Vaccari & Marschark, 1997).

### ***SED in typically hearing children***

In children who are typically developing and have normal hearing, SED includes the acquisition of skills for effective and positive communication, building social networks, independent thinking, emotional and motivational understanding of both self and others, flexibility, and empathy. Typically, SED includes acquisition of a variety of skills that are developed over a lifetime. Social emotional skills can vary between people due to personality, values, education, relationships, and the norms they are exposed to (Calderon & Greenberg, 2011).

In typically developing children, SED can vary slightly between children, but development typically proceeds as follows (Center for Disease Control and Prevention, 2019; *Social-Emotional Development and Skills for Kids*, n.d.);

0-3 months	<ul style="list-style-type: none"> <li>• Responds to interactions by smiling and making eye contact</li> <li>• Expresses themselves through facial expressions and bodily expressions</li> <li>• Develops ways to soothe and calm themselves (ex: sucking their thumb)</li> </ul>
4-6 months	<ul style="list-style-type: none"> <li>• Begins to copy facial expressions and movements of those around them, responds to other's emotions</li> <li>• Begin to express a desire to engage with their surroundings (ex: cries when playing stops)</li> <li>• Looks at self in mirror</li> </ul>
7-9 months	<ul style="list-style-type: none"> <li>• Expresses anxiety or uneasiness when around strangers (result of being more comfortable with those who they have an emotional attachment to)</li> <li>• Engages in games like "peek a boo"</li> </ul>
10-12 months	<ul style="list-style-type: none"> <li>• Begins to gain independence by playing and exploring on their own</li> <li>• Begins to demonstrate their likes and dislikes (ex: refusing certain foods)</li> <li>• Continues to express uneasiness or fear around strangers</li> <li>• Imitates play</li> <li>• Begins to attempt getting people's attention by repeating sounds and gestures</li> <li>• Puts out arms or legs to help with dressing</li> </ul>
12-24 months	<ul style="list-style-type: none"> <li>• Continues to engage in behavior that can result in independence</li> <li>• Begins theory of mind development</li> <li>• Engages with other children, but may not share toys</li> <li>• Shows affection with familiar people</li> <li>• Explores on own with parent close by</li> </ul>
24-36 months	<ul style="list-style-type: none"> <li>• Copies others, plays with other children and begins to include them</li> <li>• Demonstrates variety of emotions (ex: excitement, defiance)</li> <li>• Demonstrates personal needs and wants (ex: can begin to demonstrate self-care)</li> </ul>
36-48 months	<ul style="list-style-type: none"> <li>• Cooperates and engages with children during play</li> <li>• Begins to understand how to work through problems</li> <li>• Begins to use words to communicate needs</li> <li>• Continues to engage in independence</li> </ul>
48-60 months	<ul style="list-style-type: none"> <li>• Possesses ability to create and develop friendships</li> <li>• Develops theory of mind</li> <li>• Engages in real life and make-believe play</li> </ul>

***SED in children who are deaf or HOH***

Development, including SED, is dynamic. SED is constantly changing as a child grows. In families of children who are deaf or HOH, the changes in development may require ongoing adjustments to intervention strategies and may require new kinds of additional support to meet the needs of children and their families. To support their children's social emotional skills, families of children who are deaf or HOH need to continue to be involved in their child's progress and possibly be engaged in different communities (such as the Deaf community) (Calderon & Greenberg, 2011). SED can also be fostered through motivation and initiative of engaging in relationships with others.

If a child is continually facing adversity when communicating, they may lag in developing social emotional skills. Also, due to delays in language development, children with hearing loss tend to exhibit poorer emotional regulation and typically have difficulties expressing their emotions because of impoverished vocabulary (Calderon & Greenberg, 2011). The inability to label emotions may also be a contributing factor to delays in the SED of children who are deaf or HOH.

Wong et al. (2018) examined areas of psychosocial development including SED in children who use hearing aids (HA) or cochlear implants (CI). They found that when separating emotional behaviors from social behaviors, emotional difficulties or behaviors were within one standard deviation of the mean of the normal population, whereas social behaviors and skills of a child using a HA or CI fell more than one standard deviation below the mean. The same study found that even if children had developed "good language ability" through the use of a HA or CI, their social emotional skills may still be impacted as language is not the only contributor to psychosocial outcomes.

### *Early Intervention and SED*

Children with hearing loss have delayed language development compared to typically hearing children (Stika et al., 2015); however, children with hearing loss who receive early intervention have significantly higher language development compared to children who are later-identified (Yoshinaga-Itano, 2002). If children who have a hearing loss are provided with intervention by 6 months of age, they are more likely than later identified children to have language capabilities similar to their peers without hearing loss (Moeller, 2000). A study that examined developmental outcomes of children with hearing loss who were identified early and provided early intervention found that the majority of parents felt that the early intervention helped them learn and understand their child's needs, identify and learn about how their child is developing, and encouraged the use of techniques to promote their child's development and progress (Stika et al., 2015).

Language acquisition is encouraged when a parent is responsive to a child's attempts at producing language, but this can be a barrier for deaf or HOH children if they are only in hearing environments, as their ability to communicate, both receptively and expressively, is often impaired. Pressman et al. (1998) examined if children who have challenges developing language in hearing environments benefited from sensitive parenting and emotional availability in terms of improved language gain. The study noted that deaf children who had hearing mothers often experienced briefer interactions with miscommunications and interruptions. The study found that a child's emotional availability was a significant predictor for language gain, suggesting that emotions and motivation are related to language development.

Past research that has assessed SED has also examined it in the scope of universal newborn hearing screening (UNHS) in elementary age deaf children and in children who are deafblind.



Early intervention was found to have an indirect impact on SED due to improving language outcomes (Yoshinaga-Itano, 2002). It has been suggested that SED can be impacted through participation and involvement of the family in intervention. That is, intervention may be most effective when providers support the family as they work through the grieving process and support establishing attachment through the emotional availability of the mother to the child and of the child to the mother (Yoshinaga-Itano, 2002).

A study assessing SED in children who are deafblind found that genetic and sensory problems, as well as family stress, resources available, and difficulty with self-regulation and monitoring can impact SED (Hartshorne & Schmittel, 2016). The same study stated that a requirement for SED is interactions with others, and children who are deafblind encounter barriers, limiting their ability to interact with others, leading to stress and isolation, which hinders SED. Children who are deafblind or have other disabilities also tend to experience peer rejection, which can create negative relationship representations, and does not allow for practice of social rules when engaging in an interaction or communication attempt (Hartshorne & Schmittel, 2016).

Vogel-Walcutt et al. (2011) compared the SED of deaf and hearing children in elementary school. Although the study found that there were no differences in the development of social skills for their sample, they found that there were significant differences in the areas that involved school interest and on-task behaviors. Typically hearing children were more interested at school and seemed to be more on task than deaf children. They proposed that deaf children may not have the same level of being on task due to having difficulty paying attention to multiple stimuli at the same time.

Other research that examined SED in children who are deaf or HOH also examined the resources that parents have as well as their stress. The study found that there was a correlation between a parent's resources, their stress, and the socioemotional problems their child exhibits. Specifically, it was found that high stress in parents of children who are deaf or HOH led to frequent socioemotional problems in their child with hearing loss (Hintermair, 2006). The access to resources for social and personal needs was associated with stress, with more support and resources leading to lower amounts of stress. The findings from this study support that it is important for parents of a child who is deaf or HOH to have resources, orientation, counseling, and support through early intervention and throughout their child's school years.

Communication between parents and their children with disabilities is usually different than that of parents and children without disabilities. A study conducted by Vaccari and Marschark (1997) investigated how communication could be altered in families with children with hearing loss. Children who are deaf or HOH were found to experience different or even strained communication with their parents. This difficult and often ineffective communication can impact different areas of development including SED (Vaccari & Marschark, 1997), and even if parents of deaf children develop alternative strategies that are nonverbal, communication can be impacted due to fluency. Of children who are deaf or HOH, 90% have hearing parents. These parents typically lack the ability to sign well which can impact the social interaction skills a child is learning. For children born to hearing parents, typical and age appropriate SED is associated with a child's degree of hearing loss and is most impacted when parents rely heavily on spoken communication (Vaccari & Marschark, 1997).

**Instrument: Greenspan Social Emotional Growth Chart (GSEGC)*****Greenspan Social Emotional Growth Chart (GSEGC)***

SED can be measured and quantified using a variety of tools. To assess and quantify SED in this study, the GSEGC was used. The GESEGC was developed by Stanley Greenspan, M.D. in 2004. It is a screening tool that examines social emotional milestones of children birth to 42 months of age (McCrae & Brown, 2018).

The GSEGC is a questionnaire that is intended to be filled out by parents and/or caregivers of the child who is being assessed. There are 35 items which take approximately 10 minutes to complete. For each item, parents indicate the frequency a behavior is produced by choosing “Can’t tell, None of the time, Some of the time, Half of the time, Most of the time,” or “All of the time.” Test items are grouped into different stages that build upon each other, and each stage is associated with an expected age range. A parent or caregiver only answers questions up to those associated with their child’s chronological age. If a parent has a child who is 42 months old, the whole questionnaire is completed. An example of a question in the first stage that is intended for children 0-3 months is “Does your child look at interesting sights, such as your face or a toy?” and an example of a question in the last stage for children 31 to 42 months of age is “Does your child play make-believe with you or others where the story makes sense (e.g., have the bears go visit grandmother and then have a big lunch)?” (Greenspan, 2004). After the GSEGC is completed by parents, it is then scored by an interventionist/professional (Breinbauer et al., 2010).

The GSEGC is divided into the following eight functional emotional stages;

- Stage 1: (0-3 months) Growth in self-regulation and interest in the world
- Stage 2: (4–5 months) Engagement in relationships
- Stage 3: (6–9 months) Use of emotions in an interactive purposeful manner

- Stage 4a: (10–14 months) Use of interactive emotional signals or gestures to communicate
- Stage 4b: (15–18 months) Use of interactive emotional signals or gestures to solve problems
- Stage 5a: (19–24 months) Use of symbols or ideas to convey intentions or feelings
- Stage 5b: (25–30 months) Use of symbols or ideas to express more than basic needs
- Stage 6: (31–42 months) Creation of logical bridges between emotions and ideas

The instrument is norm referenced using data obtained from 456 children living in the United States (Greenspan, 2004). After the GSEGC is completed, a child's score can be compared to the test norms to obtain a scaled score and percentile rank.

***Reliability, validity, and sensitivity***

The reliability and validity of the GSEGC was assessed in a study conducted by Tede et al. (2016). The study focused on children with developmental delays and autism. To examine the internal reliability of the GSEGC (assessing how well the GSEGC measures the same construct throughout the assessment), three different groups were examined: children with autism spectrum disorder (ASD), children with a language disorder, and children with a delay in motor development. The design of the study involved assessing children from two-parent families by asking parents to fill out the GSEGC together at different times in the study. The researchers concluded that the GSEGC had a clinical utility of identifying children at low risk for ASD, and the tool had sensitivity (accurately identifying those with ASD) and reliability for screening children for social-emotional deficits early in childhood, but the authors indicated that it should be tested more cross culturally. In a different study, the GSEGC was found to have a sensitivity of 86.6%, meaning that the tool correctly identified 86.6% of the children who had ASD. The tool had a 90% specificity, indicating that it correctly identified 90% of typically developing children (McCrae & Brown, 2018).

Because of the ease of the tool and cost, the GSEGC can be used in low and middle income countries to help screen for developmental delays, autism, or other developmental characteristics (Marlow et al., 2019). The tool has limitations, including having no normative data for children who do not speak and understand English, and it does not consider children with a developmental risk factor due to parents' education levels and social or socioeconomic status (Tede et al., 2016).

Greenspan (2004), the creator of the GSEGC, also reported reliability (specifically, internal consistency) and validity for this tool. To assess internal consistency (measuring the similarity of responses within items asked), the GSEGC was administered to 456 individuals. The children in the study were selected through a stratified random sampling to obtain a representative sample. The participants selected were able to speak and understand English, had normal hearing or vision with and without the use of an aid, and did not have a developmental risk factor associated with social, socioeconomic, or parental education factors. The participants were asked to complete the GSEGC by an examiner who then collect the assessments and verified completion. Through the use of Fisher's z transformation, the reliability for the Total Growth Score ranged from .83 to .94 alpha coefficients, indicating high reliability. To establish validity (analyzing if the GSEGC is measuring what it is intending to measure), a clinical group comprised of 68 children ages 4 to 42 months that presented with developmental delays in cognition, motor, or language, or had autism were matched with a typically developing control group. The clinical study group was found to have "less developed social emotional skills" than the control group.

***GSEGC in past research***

The GSEGC has been used in research to measure SED in a variety of populations, primarily focusing on children with language impairment and autism spectrum disorder. Examining SED in children with language impairment, Aarne et al. (2014) compared typically developing children with children who had a language impairment. The study included 50 children who were recruited from six different speech language pathology clinics. The children had diagnosed language impairments, had normal hearing, and had normal psycho-motor development. In this study, the caregivers of the participants were asked to fill out the GSEGC based on their child's current status. The study utilized the GSEGC to consider how social-emotional development can be a basis for language and cognitive development. The researchers obtained a total GSEGC score which was used to categorize a child as demonstrating full mastery, emerging mastery, or possible challenges relative to the child's chronological age. Using a one-way ANOVA for statistical analysis, this study found that there was an association between language and SED. The results from this study indicated that children with a language impairment had significantly lower scores on SED than typically developing children. This study also made a distinction between the presymbolic (developing self-regulation, attachment, etc.) and symbolic (linguistic representation, functional play, etc.) measures within the GSEGC and found that children with a language impairment had better scores when measuring presymbolic stages rather than symbolic stages.

Assessing children with autism spectrum disorder (ASD), Ingersoll (2012) used the GSEGC to investigate if teaching children imitation could lead to improvements in social functioning. The researchers focused on 27 children with autism who were 27 to 47 months old and used an adaptation of the GSEGC, called the Social-Emotional Scale of the Bayley Scales of

Infant Development to measure the acquisition of social-emotional milestones. The researchers used the GSEGC adaptation at pre-treatment and post-treatment phases. The treatment in this study included teaching a group of children imitation techniques that could be used during social interactions as a form of an appropriate response. At the end of 10 weeks, after receiving the treatment for 1 hour a day, three times a week, the adaptation of the GSEGC was administered. The author of the study concluded that there was a significant difference in scores on the GSEGC adaptation pre and post treatment. The scores were higher at the end of the intervention, indicating that the imitation treatment was effective in children with ASD and suggested that imitation can mediate the development of social emotional functioning.

### ***Justification for use in this research***

The GSEGC can be used to measure SED in deaf and HOH children as it can identify the child's level of early social emotional skills, which could have an impact on healthy emotional regulation and successful social functioning (Silvey, 2010). Monitoring a child's early SED can indicate if a child may be experiencing deficits and if intervention is needed to help a child reach specific milestones. Children who are deaf or HOH may need additional help achieving SED milestones as most of the milestones depend on communication between the caregivers and the child which is often impacted in deaf or HOH children with hearing parents.

### **Statement of Purpose**

The purpose of this study was to examine SED in children who are deaf or HOH, as previous research has shown that children with hearing loss experience greater dysfunction than typically hearing children in social-emotional areas such as behavior and self-esteem (Vaccari, 1997). These issues in SED can negatively impact a child's interaction skills, academic abilities,

and interpersonal connections. This research explored if children who are deaf or HOH demonstrate a higher degree of social emotional issues as early as one to three years of age. This project also investigated if there are specific social-emotional skills that are most at risk for delay in children with hearing loss and if there are differences in SED between children 9 to 19 months of age versus 26 to 37 months of age. Three questions were addressed in this study:

-Question 1) Do children who are deaf or HOH demonstrate delay in SED compared to typically hearing children?

-Question 2) Are there certain social emotional skills that the children have difficulty with?

-Question 3) Is there a difference in mean social emotional percentile ranks in children who are longitudinally measured at approximately 15 months versus 31 months of age?

### ***Rationale***

SED can impact many things in children, including their mental health. Remine and Brown (2010) examined the prevalence of mental health problems in children who are deaf and found that although rates of mental health problems were similar to the hearing population, parents with deaf children reported higher rates of concern for social problems, anxiety/depression, and thought problems. Children with severe and profound hearing loss have been found to also have problems with internalizing behaviors, regulating their emotion, social understanding, and attention (Stika et al., 2015).

Understanding how SED is impacted within the deaf and HOH population could provide insight into how development is altered which can inform early intervention practice. Possible modification of intervention could help children who are experiencing altered SED to work towards having age appropriate social-emotional skills. This research could be used to identify the areas that are most problematic for children with hearing loss, which could guide



interventionists in knowing which skills to focus on in an effort to minimize the future dysfunction that children could experience in terms of SED. This is important as there is a lack of literature on children with hearing loss and SED. Although there are studies examining overall development, including language development, in this population, there needs to be research dedicated to the psychosocial development and wellbeing of this population.

In this study, data were collected from children 9 months to 37 months of age. Examining the results of this age range is important as children are rapidly developing at an early age. There is a typical timeline of overall development that includes synaptogenesis and pruning of neurons that impact a child's development, typically ending around the age of 2 years. During this timeframe, and up to adolescence, it is important for children to experience things, such as communication, language, vision, and hearing so that the brain can effectively encode and allocate brain areas for processing this information. Among these experiences, SED is included. There are crucial time periods in a child's early development where a child must experience or learn certain things that will be the foundation of learning and processing of other knowledge. If SED is not addressed early on, dysfunction of these skills can be expected as a child gets older, impacting things such as their ability to self-regulate their emotions, develop interpersonal skills, and engage with their emotions in different environments.

## **Methods**

### **Participants**

#### ***Study participants: Questions 1 and 2***

Participants were part of the National Early Childhood Assessment Project (NECAP). The purpose of the NECAP project was to examine developmental outcomes of young deaf and

HOH children across the United States. All the children were diagnosed with a hearing loss and resided in Wisconsin, which was the only NECAP state that contributed an assessment for SED. For this study, participants from NECAP who had co-occurring disabilities that could impact language development or were older than 42 months of age were excluded. To answer questions 1 and 2 of this study, participants were split into two groups based on whether it was their first (younger group) or second (older group) time completing the assessment. The younger group consisted of 78 children ages 9 to 19 months (mean age = 14.4 months), and the older group was comprised of 58 children ages 26 to 39 months (mean age = 31.4 months). A total of 23 children did not complete/participate in a second assessment.

Participants ranged from 9 months of age to 39 months of age. For race, 88.3% identified as White, 5.2% identified as Black, and 6.5% identified as belonging to another minority group. All the participants had congenital hearing loss, and all were identified with hearing loss before nine months of age. Of the participants who used spoken language, 97.4% spoke English, and the other 2.6% spoke Spanish. Modes of communication ranged from spoken language only to sign language only (see Table 1).

**Table 1**  
**Percentage of Participants in Each Communication Mode Group**

Mode of communication	# of participants	Percentage of group
Spoken language only	19	24.4%
Spoken language with occasional sign language	51	65.4%
Spoken language with sign language	7	9%
Sign language only	1	1.3%

Of the participants, 75% had a bilateral hearing loss and the other 25% had unilateral hearing loss. Preliminary analysis revealed no statistically significant differences in SED between children with bilateral loss versus unilateral loss, so these two groups were merged

together for all analyses. Audiological records were available for all but 11 participants. For participants with audiologic records available, degree of hearing loss ranged from normal (in the better ear for those unilateral hearing loss) to profound hearing loss. Of children with bilateral hearing loss, most participants had mild or moderate hearing loss. See Table 2 for the percentage of children in each category of hearing loss.

**Table 2**  
**Percentage of Children in Each Degree of Loss Category**

Classification	# of participants	Percentage of group
None	16	23.9%
Mild	15	22.4%
Moderate	14	20.9%
Moderately severe	6	9%
Severe	5	7.5%
Profound	7	10.5%
Unknown	4	6%
Missing	11	(not included)

Most participants used some type of amplification. The most prominent type of amplification was hearing aids, followed by participants using no amplification. Only one participant used a combination of amplification, specifically, a hearing aid with a cochlear implant.

**Table 3**  
**Type of the Amplification Used by Participants**

Amplification	# of participants	Percentage of group
None	11	14.1%
Hearing aids	53	67.9%
Cochlear implant	8	10.3%
Bone conduction aid	5	6.4%
Hearing aid and cochlear implant	1	1.3%

***Study Participants: Question 3***

The group of participants that were used to examine question 3 were derived from the participants included in Questions 1 and 2. Of the 78 children who had completed the GSEGC at Time 1, 55 also participated at Time 2. Question 3 only included the 55 children who were longitudinally tested at both time points. Group one called “Time 1” includes data from when the participants were 10 to 19 months of age (mean age = 14.6 months), and group two, identified as “Time 2”, includes data from the participants at age 29 to 37 months (mean age = 31.5 months). At Time 1, most participants completed questions 1-17 of the GSEGC, while at Time 2, questions 1-28 were completed.

**Procedure**

The GSEGC was mailed to each participant’s home along with a measure of general development and a language assessment. Parents completed the forms and mailed them to the NECAP liaison in Wisconsin. The liaison then reviewed the forms for completeness and consistency and sent them to the NECAP research team at the University of Colorado Boulder. All GSEGCs were scored by lab personnel and were checked by a second person. Scaled scores and percentiles were determined, along with a total growth score. The assessments were then entered into SPSS where each child’s age and answers to each question were recorded, along with growth scores, scaled scores, and percentiles. The percentiles and scaled scores were determined based on the normative tables for the GSEGC. All analyses were conducted using SPSS.

## **Results**

### ***Question 1: Do children who are deaf or HOH experience a difference in SED compared to typically hearing children?***

After the caregivers/parents of the participants completed the GSEGC, a scaled score and percentile was determined based on their responses. A scaled score represents the total score converted to a score that can be compared. For this assessment, a scaled score of 10 represents the mean of the normative sample, and a score of 7 indicates one standard deviation below the mean. A percentile is a measure that allows for comparison within a given population. A child's percentile rank indicates the percentage of the population that scored below that child. The mean and range for chronological age, scaled score, and percentile for each group are shown in Table 4.

**Table 4**  
**Mean and Range for Chronological Age, Scaled Score, and Percentile**

		<b>Age at time of assessment (months)</b>	<b>Scaled score</b>	<b>Percentile</b>
Younger group (n=78)	<b>Mean</b>	14.35	8.74	37.89
	<b>Minimum</b>	9	2	.4
	<b>Maximum</b>	19	18	99.6
Older group (n=58)		<b>Age at time of assessment (months)</b>	<b>Scaled score</b>	<b>Percentile</b>
	<b>Mean</b>	31.43	10.12	50.48
	<b>Minimum</b>	26	3	1
	<b>Maximum</b>	39	18	99.6

In a normal population, it would be expected that 10% of the population would fall below the 10<sup>th</sup> percentile. In the younger group, 28.2% of the participants fell below the 10<sup>th</sup> percentile, and in the older group, 21.1% of the participants fell below the 10<sup>th</sup> percentile. Because these percentiles are higher than 10% of the participants in each group, this indicates that a greater percentage of children who are deaf or HOH are experiencing a delay or dysfunction in SED

skills than would be expected in a typical population. Table 5 (below) includes the number and percent of children obtaining each percentile rank below the 10<sup>th</sup> percentile.

**Table 5**  
**Percentile Ranks for Total Growth Score (Only Ranks less than the 10<sup>th</sup> Percentile are Reported)**

	Percentile	Frequency	Percent of participants	Cumulative percent
Young group (9-19mo)	.4	3	3.8	3.8
	1	2	2.6	6.4
	2	1	1.3	7.7
	5	9	11.5	19.2
	9	7	9	28.2
	Percentile	Frequency	Percent of participants	Cumulative percent
Old group (26-39mo)	1	1	1.7	1.8
	2	1	1.7	3.5
	5	4	6.9	10.5
	9	6	10.3	21.1

***Question 2: Are there certain social emotional skills that the children have difficulty with?***

The GSEGC contains a total 35 items that are divided amongst eight age groups. Per the manual of the GSEGC, an item was assigned to an age group based on the lowest chronological age at which children in the normative sample achieved an average response of 4.0 or higher on the item (which equates to responses of “Most” or “All” of the time). A child’s parent or caregiver answers items starting at the beginning of the assessment and stops when they reach the section that corresponds to their child’s chronological age.

The tables below display the results for each group, the younger group (ages 9-19 months) and the older group (26-39 months). For each item, the percentages of participants who indicated “Most” or “All of the time” are provided. The GSEGC test manual states that the age range provided for each item is consistent with the age at which the vast majority of children in the normative sample showed mastery of the item. For the current study, items for which less

than 80% of the parents indicated their child could do the skill “most” or “all” of the time are highlighted in Figures 1 and 2. For the younger group, an item analysis was conducted up to question 17, as most of the participants in the younger group completed the questions up to the stage corresponding to 14 months of age. The older group includes an item analysis up to question 28, as majority of the participants completed items up to the stage corresponding to 25-30 months of age. A full list of the questions on the GSEGC can be found in Appendix A.

**Table 6**  
**Percentage Indicating “Most” or “All” of the Time For Each Item in Younger Group**

Younger group			
Question	Percentage of Most + All	Question	Percentage of Most + All
1	80.8	10	98.7
2	65	11	73.3
3	91	12	98.7
4	87	13	96.1
5	86.8	14	81.8
6	86.9	15	92.2
7	94.8	16	79.2
8	87	17	62.7
9	92.2		

**Table 7**  
**Percentage Indicating “Most” or “All” of the Time For Each Item in Older Group**

Older group			
Question	Percentage of Most + All	Question	Percentage of Most + All
1	89.7	15	100
2	78	16	96.5
3	96.6	17	94.8
4	93.2	18	86.2
5	86.5	19	94.8
6	96.6	20	96.4
7	94.9	21	86.2
8	94.9	22	86.2
9	89.7	23	86.2
10	98.3	24	89.7
11	82.4	25	75.9
12	100	26	75.8
13	94.8	27	74.1
14	98.3	28	76.7

In the younger group, questions that showed difficulty for the participants were question numbers 2, 11, 16, and 17. For the older group, questions that showed difficulty in mastery were question numbers 2, 25, 26, 27, 28. Note that both groups did not meet an 80% criteria of “Most” or “All” responses for question 2. This question asks a parent “Can you easily get your child’s attention without having to be very dramatic?” Questions that did not meet an 80% “Most” or “All” criterion are listed in Table 8.

**Table 8**  
**Questions not Meeting an 80% Criterion**

GSEGC Question	
Question 2	Can you easily get your child’s attention without having to be very dramatic?
Question 11	Does your child look or turn towards interesting sounds?
Question 16	Does your child show you that he or she understands your actions or gestures by making an appropriate gesture in return?
Question 17	Does your child use many consecutive actions in a back and forth way to show you what he or she wants or to have fun with you?
Question 25	Does your child play make-believe?
Question 26	Does your child use words or pictures to tell you what he or she is interested in?
Question 27	Does your child use words with one or more peers?
Question 28	Does your child use words or pictures to show what he or she likes or dislikes?

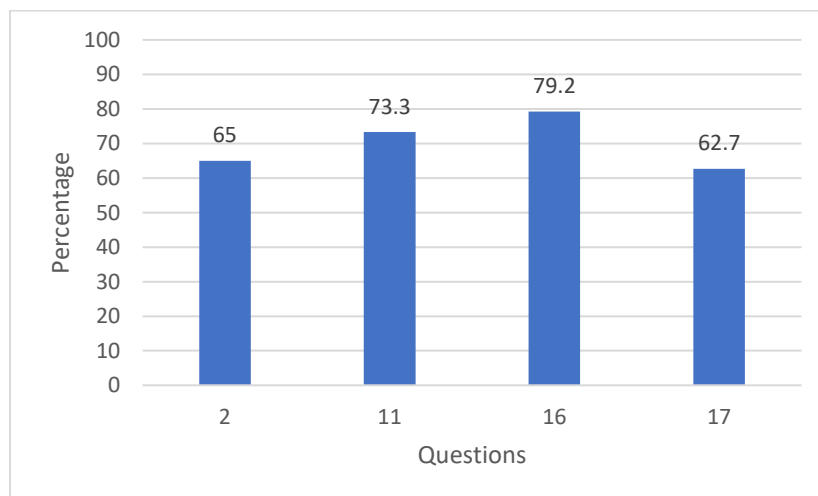


Figure 1: Items not Meeting an 80% Criterion and Percentage of Participants Indicating “Most of the Time” or “All of the Time”



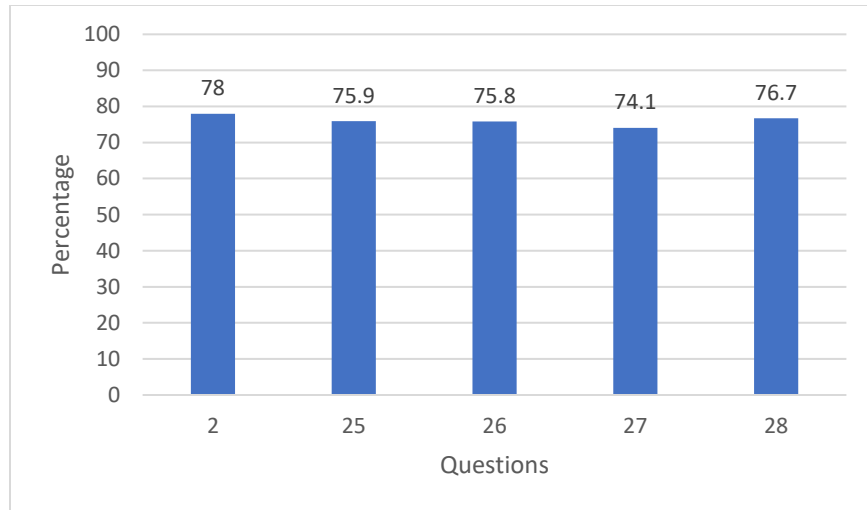


Figure 2: Percentage of Participants that Indicated “Most of the Time” or “All of the Time” but did not Meet a 80% Threshold.

***Question 3: Is there a difference in mean social emotional percentile ranks in children who are longitudinally measured at approximately 15 months versus 31 months of age?***

The GSEGC was completed twice, once at Time 1 (assessment at the age of 10-19 months) and again at Time 2 (assessment at the age of 29-37 months). A paired samples t-test was conducted, comparing the mean percentile between the two age groups (see Figure 3). The percentile rank at Time 2 is significantly higher than at Time 1 ( $p=.008$ ).

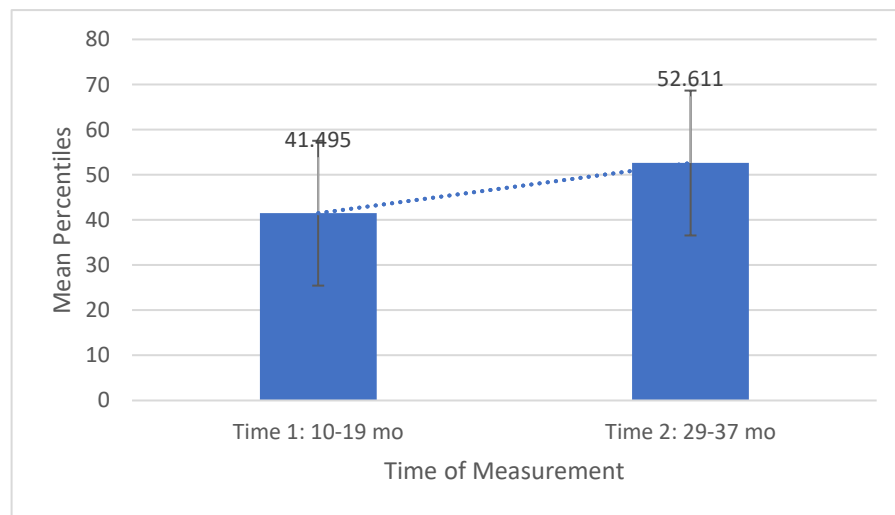


Figure 3: Mean percentile from scores at Time 1 and at Time 2 ( $p\text{-value} = .008$ )

The results above indicate that percentiles for the cohort increased from Time 1 to Time 2. It can be inferred that the statistically significant difference in the mean percentile indicates that at Time 2, participants scored better on the GSEGC. This means that children are performing closer to age expectations as they get older.

## **Discussion**

The results of this study show that children who are deaf or HOH experience difficulty and a delay in the acquisition of social-emotional skills. Failure in addressing the deficit and delay in SED in children who are deaf or HOH can result in difficulty or the inability to manage and express emotions as an adult, as well as impede the ability to socialize with others. Although the rates of mental health issues are similar between the deaf and HOH population and the hearing population, parents of children who are deaf or HOH report higher rates of anxiety and depression (Remine & Brown, 2010), and children who have severe and profound hearing loss tend to experience difficulty with internalization of behaviors and emotions, as well as social understanding and engagement (Stika et al., 2015).

***Question 1: Do children who are deaf or HOH experience a difference in SED compared to typically hearing children?***

When looking at percentiles, it would be expected that only 10% of the population would be under the 10<sup>th</sup> percentile. In the younger group, 28.2% of the participants fell below the 10<sup>th</sup> percentile, while in the older group, 21.1% of the participants fell below the 10<sup>th</sup> percentile. These results indicate that children who are deaf or HOH experience more difficulties in their SED than do their typically hearing peers.

The findings of this study show that children below the age of 3 with hearing loss are not developing social emotional skills at the same rate as typically hearing children. SED involves the ability to manage emotions, engage in relationships, and acquire the skills for social cognition (Greenspan, 2004). Given the greater percentage of children falling under the 10<sup>th</sup> percentile, children who are deaf or HOH are not acquiring social-emotional skills at similar rates as other children, which if left unaddressed, could impact their future communication, ability to express and manage emotions, and their exploration of emotions in different social situations and environments.

The results of the present study are consistent with those of Wong et al. (2018). In their study of children who used amplification, specifically hearing aids or cochlear implants, emotional skills were within one standard deviation of a normally hearing population, but difficulty in social behaviors and skills were evident, falling more than one standard deviation from the norm set by normally hearing children.

***Question 2: Are there certain social emotional skills that the children have difficulty with?***

The younger group showed difficulty in achieving and surpassing a threshold of 80% for “Most” or “All” of the time for questions 2, 11, 16, and 17. The older group did not meet the 80% threshold on questions 2, 25, 26, 27, 28. Due to the design of this assessment, it is expected that the vast majority of children should be able to meet the requirements of completing the items up to their age category.

Both the younger age group and the older age group did not meet the criterion for question 2, which asks a caregiver “Can you easily get your child’s attention without having to be very dramatic?” Parents and caregivers of deaf or HOH children could be overly dramatic in their actions in trying to compensate for their child’s inability to hear when they attempt to get

their attention. Because instruments like the GSEGC were created by doctors and professionals, the way caregivers interpret items can differ (Patrick et al., 2018). Some caregivers could be looking for certain indicators to meet this response, while others may have a more relaxed criterion. Children could have also had difficulty with question number 2 given that it pertains to sensory processing as well as SED.

The younger group also did not meet the criterion for question 11, which corresponds to “Does your child look at or turn towards interesting sounds?” This item revolves around the basis of having the ability to hear, so it would be expected for children who are deaf or HOH to have difficulty with this item as their ability to hear is impaired.

The younger group also experienced difficulty with questions 16 and 17, while the older group also had difficulty with questions 25 through 28. For both of these groups, these questions are ones that correspond to the end of their age group, so it may be expected that they are not meeting the 80% criteria because these items are touching up to their “ceiling.”

***Question 3: Is there a difference in mean social emotional percentile ranks in children who are longitudinally measured at approximately 15 months versus 31 months of age? Are the children’s social emotional skills closer to age expectations as they get older?***

The study found that between Time 1 (10-19 months) and Time 2 (29-37 months) the mean percentiles for the group increased. This finding was statistically significant. The mean percentiles were taken from each group, based on the questions that corresponded with their age, and were compared over at least a 10-month period. This study showed that at Time 1, where children are younger and around one to one and a half years old, children are delayed in SED. However, due to the increase of the mean percentile at Time 2, it seems that at least some of the children who were delayed caught up to typically developing peers.

An explanation for the increase in SED at Time 2 could be related to the child having more experience and engagement in different environments, that parents and caregivers are learning how to better communicate with their child, or it could simply be due to development over time. As a child grows older, parents and caregivers could begin to develop more effective ways of communicating, allowing the child to engage more socially and emotionally with their parents. These communication strategies might take form in many adaptations, including parents learning sign language, or children and parents learning about new communication methods through intervention. At Time 2, children were around two to three years old, and some of them may have participated in educational settings like preschool and daycare, which could be another aid helping them develop social emotional skills, especially as they are engaging socially with classmates and experiencing new emotions in different environments.

Although in the older age group 21% of children fell below the 10<sup>th</sup> percentile in SED, the findings indicate that children who are deaf or HOH are advancing in their social emotional skills over time, rather than losing social emotional skills or experiencing a standstill in their SED.

### ***Limitations***

The GSEGC is an assessment that is intended for a caregiver to fill out in which they estimate the frequency with which their child does a behavior. Because this is filled out by a caregiver, the GSEGC can be subjective. Some caregivers may be over or understating the frequency they are seeing certain behaviors. Some of the items on the GSEGC are not specific and may be open to interpretation. This can result in caregivers interpreting a given item differently.

Items on questionnaires that require parents to indicate observable behaviors are easier to report, while more subjective items can differ in responses, as some caregivers may have heightened sensitivity for certain actions or events over others (Patrick et al., 2018). For example, question number 2 on the GSEGC asks “Can you easily get your child’s attention without having to be very dramatic?” Different caregivers and parents would have had a different interpretation of being dramatic, as well as could use/look for different behaviors that their children express to demonstrate “getting their attention”. Some caregivers may take their child simply looking at them as having their attention, while others may want a verbal response or certain action done before they consider that to be getting their child’s attention.

### *Assessment tool*

In previous studies (ex: McCrae & Brown (2018); Tede et al. (2016)), the GSEGC has mainly been used in populations composed of children with autism to examine their SED. To our knowledge, there are currently no other studies using the GSEGC as a tool to measure SED in children who are deaf or HOH.

Examining the items on the GSEGC, especially after question number 18, there are various questions that depend on some form of language and communication. Some of the questions explicitly ask for verbal responses, like words or phrases, while others ask the caregiver if their child can understand them. If a deaf child is born to hearing parents, communication may be impaired if the child is more comfortable using a signed language, while their parents are trying to communicate orally. Or if a child is HOH and parents are attempting to use amplification to support communication, the child may still be working on gaining the skills to correctly use and communicate with their ability to hear. Within the GSEGC, there are questions that rely on verbal language, as well as questions that rely on language comprehension

and language expression. For example, question number 24 relies on verbal communication, asking “Does your child show you he or she understands your simple verbal wish?” This question is reliant on both verbal language and comprehension, so the area of SED that this question is examining could be problematic for children who are deaf or HOH if they cannot comprehend verbal language. Question numbers 27 and 28, which were difficult for the older group of children, also rely on language expression. The GSEGC expects children who are 25 months or older to have the ability to use various words to express their feelings and/or engage with others. Question number 27 asks “Does your child use words with one or more peers” and question number 28 asks “Does your child use words or pictures to show what he or she dislikes?” If a child who is deaf or HOH is experiencing impaired language input, they may be unable to successfully express themselves in certain situations.

Development of social-emotional skills at the ages of 19 and 25 months can involve other aspects that are not heavily based on language. For example, around 19 months, a child can engage in independent behavior, while at around 25 months, a child can show emotion and affection, demonstrate self-care, as well as needs and wants (Center for Disease Control and Prevention, 2019) (*Social-Emotional Development and Skills for Kids*, n.d.). Thus, the GSEGC could have provided less language-dependent questions rather those that were actually included.

### ***Potential Clinical Implications***

Current intervention for children who are deaf or HOH typically focuses on language development. Previous research has found that early intervention results in significantly higher language development compared to children who were later-identified and began intervention later (Yoshinaga-Itano, 2002). Other research has also found that early intervention mediates long term outcomes. Establishing early intervention procedures addressing SED for children who

are deaf or HOH may support them in gaining social-emotional skills to be successful in engaging with their emotions and relationships in the future. The modification of early intervention to include attention towards developing social emotional skills could potentially reduce negative outcomes (Vaccari & Marschark, 1997).

Intervention could also encourage social and emotional availability of parents and caregivers for children who are deaf or HOH. Caregivers and parents of children who are experiencing a delay or difficulty in SED can support their children by being involved in their progress and motivating and initiating relationship engagement, as social engagement and communication with others can help develop social emotional skills (Calderon & Greenberg, 2011). Previous research has also found that children with difficulty (in developing language) benefited from sensitive parenting and emotional availability (Pressman et al., 1998), and children who are deaf or HOH were more responsive to maternal emotional availability. Parental engagement could help this population in gaining skills within SED. While parental engagement could help children who are deaf or HOH gain social emotional skills, continued support will be important to provide to hearing parents who may be experiencing difficulty in emotionally connecting and bonding with their child if they perceive their child as having a deficit or are ashamed of their child's inability to hear.

### **Future Directions**

The results of this study suggest that children who are deaf or HOH experience some developmental differences in SED compared to children who are typically hearing. If this study were to be replicated in the future, a different assessment should be considered, a cohort of



typically hearing children should also be included in order to compare SED scores and the study sample should be more representative of the population of children with hearing loss. This study was comprised of a smaller sample, limiting the generalizability. The participants within the sample were also all from one state, which is not representative of the demographics in the greater population.

Another direction to take this study could be to compare deaf or HOH children who have hearing parents to those who have deaf parents. This could provide insight into whether hearing parents are more or less emotionally available to children with hearing loss than deaf parents, and/or if there are different language modalities being used, it could provide an insight as to which may assist in SED or may hinder it. Finally, it would be interesting to expand upon the longitudinal aspect of this study. If children were tracked from birth to middle childhood or late childhood, the patterns of SED could be examined throughout a significant portion of their development, and it would allow us to determine if children who are deaf or HOH eventually catch up to their typically hearing peers.

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## Appendix

### Appendix A

Questions on the GSEGC			
1	Does your child take a calm and enjoyable interest in most sounds?	19	Does your child search for something he or she wants by looking or getting you to look for it?
2	Can you easily get your child's attention without having to be very dramatic?	20	Does your child show you what he or she wants or needs by using a few actions in a row?
3	Does your child take a calm and enjoyable interest in most sights, including colorful or bright things?	21	Does your child use words or try to use words when people talk or play with him or her?
4	Can you easily get your child to look at things without them being very bright or colorful?	22	Does your child copy or imitate familiar make-believe play?
5	Does your child calmly enjoy touching or being touched by different things?	23	Does your child tell you what he or she wants with one or few words?
6	Can you easily get your child to respond to your touch without having to touch your child firmly to get his or her attention?	24	Does your child show you he or she understands your simple verbal wish?
7	Does your child like it when you swing him or her around, dance with him or her in your arms, or quickly lift him or her up in the air?	25	Does your child play make-believe?
8	Can you easily get your child's attention by approaching him or her, or moving him or her around slowly?	26	Does your child use words or pictures to tell you what he or she is interested in?
9	Can you help your child calm down?	27	Does your child use words with one or more peers?
10	Does your child look at interesting sites, such as your face or toy?	28	Does your child use words or pictures to show what he or she likes or dislikes?
11	Does your child look or turn towards interesting sounds?	29	Does your child play make-believe with one or more peers?
12	Does your child seem happy or pleased when he or she sees a favorite person?	30	Does your child play make-believe with you or others where the story makes sense?
13	Does your child respond to people talking or playing with him or her by making sounds or faces?	31	Does your child use phrases or sentences with you to ask a question about something he or she wants to do?
14	Does your child reach for or point at things, or make distinct sounds to show you what he or she wants?	32	Can your child explain why he or she wants something or wants to do something?

15	Does your child exchange two or more smiles, other looks, sounds, or actions?	33	Does your child describe his or her feelings to explain why he or she is doing something or wants something?
16	Does your child show you that he or she understands your actions or gestures by making an appropriate gesture in return?	34	Does your child play make-believe with peers as well as adults where the story makes sense and has many parts to it?
17	Does your child use many consecutive actions in a back and forth way to show you what he or she wants or to have fun with you?	35	Does your child have a conversation with adults and peers that makes sense, with four or more back and forth exchanges about a variety of topics?
18	Does your child copy or imitate many of your sounds, words, or actions while playing with you?		