Deafness and Diversity: Early Intervention

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DEAFNESS AND DIVERSITY: EARLY INTERVENTION

EARLIER IDENTIFICATION has increased the number of infants identified with hearing loss. A significant and growing proportion of children who are D/deaf or hard of hearing have a disability (DWD). Literature related to infants and toddlers who are DWD is scarce because of the heterogeneity of the population and because many disabilities may go undiagnosed until a child is older. Service availability, professional preparation, and use of evidence-based practices must improve to best meet the needs of these children and their families. An examination of theory, research, and practice in early intervention for children who are DWD revealed a lack of qualified professionals and a need for targeted instruction in teacher preparation programs and for technological advances paired with treatment (e.g., telepractice). Increased transdisciplinary collaboration and technology utilization in teacher preparation hold promise as ways of improving service provision to young children who are DWD.

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Professionals working with infants and toddlers who are D/deaf or hard of hearing (DHH) with a disability (DWD) face a myriad of service provision challenges. T. W. Jones (1984) identified the heterogeneity of the learning characteristics and educational needs of students who are DWD as a primary challenge because it leads to difficulties in using generalizations when making educational decisions. Other challenges include the logistical and emotional complexities experienced by families of infants and toddlers who are DWD, the difficulties facing the field of early intervention (EI) as a whole, and the lack of opportunities for interaction and collaboration with other DWD EI service providers (T. W. Jones & J. K. Jones, 2003). In the present article, the authors (a) review select disabilities that commonly occur in children who are DHH, (b) examine the theoretical and practical aspects pertaining to EI with children who are DWD, (c) discuss research conducted with children who are DWD, and (d) consider practices that have potential as appropriate EI services for infants and toddlers who are DWD.

Demographics

Ninety-seven percent of newborns were screened for hearing loss in the United States in 2011 (Centers for Disease Control and Prevention, 2013); just 17 years earlier, only 3% had been screened (National Center for Hearing Assessment and Management [NCHAM], 2014; White, 2006). In the United States, newborn hearing screening (NBHS) and early hearing detection and intervention (EHDI) have led to a reduction in the average age of diagnosis from 2.5 to 5.0 years (depending on the severity of the hearing loss) to less than 6 months in many areas (Schmeltz, 2014). Children younger than 3 years represent 1.4% of the total population of children who are DHH (Gallaudet Research Institute, 2013). As noted in the introduction to this special issue of the *American Annals of the Deaf* (by Guardino & Cannon), the demographics of children who are DHH have been and continue to shift to include a growing percentage who are DWD.

DHH Infants and Toddlers With a Disability

Some common nonhereditary causes of hearing loss, and approximately one third of the hereditary causes (such as syndromes), are also associated with disabilities (Bruce, DiNatale, & Ford, 2008). Nonhereditary causes, including meningitis, may lead to hearing loss accompanied by intellectual disabilities (Vernon, 1982). Additionally, medical advances now allow more premature infants to survive. Often, however, prematurity is associated with both hearing loss (Roizen, 2003) and conditions such as cerebral palsy, intellectual disabilities, and vision loss (Vernon, 1982). Parents of young children with hearing loss should be familiar with the signs of syndromes, as the prevalence of syndromes is higher among individuals who are DHH. Conversely, if the child was not screened for hearing loss, or not identified during NBHS, it behooves professionals and the families of infants with disabilities to recognize signs of hearing loss. While it is neither plausible nor practical to discuss every possible variation, knowing common syndromes, disorders, and infections that cause hearing loss and disabilities is essential to ensuring that infants and toddlers who are DHH achieve optimal outcomes.

Syndromes and Autism Spectrum Disorder

Syndromes affect one third of children who are DWD (Picard, 2004). Because of the high rate of occurrence of syndromes that cause disabilities in individuals who are DHH, the Joint Committee on Infant Hearing (JCIH, 2007) recommends that every family of a child who is DHH be offered genetic evaluation and counseling. Down syndrome, Usher syndrome, Treacher Collins syndrome, and CHARGE syndrome are some of the syndromes most commonly associated with deafness (Picard, 2004). In addition, we will discuss autism spectrum disorder (ASD).

Down Syndrome

Estimates of the prevalence of hearing loss in children with Down syndrome (DS) vary widely, from 2% to 78% (Fortnum & Davis, 1997; A. Hildmann, H. Hildmann, & Kessler, 2002; Shott, Joseph, & Heithaus, 2001). Children with DS often experience chronic and difficult-to-resolve otitis media. With rigorous audiological management, however, less than 2% of children with DS have permanent hearing loss (Shott et al., 2001). Professionals working with children who are DHH with DS should guide families to pursue regular pediatric and otolaryngological visits to avoid middle ear difficulties.

While young children with DS tend to have delayed cognition and expressive language, and to experience poor motor coordination, relative strengths often are socialization skills, visual processing, and visual-motor coordination (Fidler, 2005; Fidler, Hepburn, & Rogers, 2006; J. E. Roberts, Price, & Malkin, 2007). Recommendations include employing interventions that utilize strengths (e.g., social skills) to improve areas of delay (e.g., motor coordination, expressive language) (Fidler, 2005). Responsive Teaching, an EI curriculum designed to address the needs of young children with developmental delays, is one such intervention. Responsive Teaching instructs parents/caregivers in how to foster their young children's cognitive and language functioning by engaging in responsive interactions (Mahoney, Perales, Wiggers, & Herman, 2006). In addition, physical therapy and speech-language pathology services are effective at helping young children with DS develop motor, language, and speech skills that more closely approximate those of their typically developing peers (J. E. Roberts et al., 2007).

Usher Syndrome

Usher syndrome (US) is the most common condition that affects both hearing and vision. US is a condition in which a child is born DHH and develops progressive vision loss in the first decade of life (Type I) or the second (Type II). Significant vision loss does not typically occur until the school-age years or later (Mets, Young, Pass, & Lasky, 2000), so early interventionists are not likely to work with the child and his or her family when orientation and mobility become major challenges. However, the interventionist has a vital role in preparing the family for the future.

All children with bilateral severe-profound sensorineural hearing loss should undergo an electroretinogram to rule out the presence of US (JCIH, 2007; Young, Mets, & Hain, 1996). Children with Type I US have limited or absent vestibular function and consequently begin walking at an average age of 23 months (Mets et al., 2000). Physical and occupational therapy can help the child and his or her parents compensate for severe balance issues. Caregivers should be encouraged to consult with a Braille/low-vision specialist and to consider learning tactile signing, if sign language will be a component of the child's communication system.

Treacher Collins Syndrome

Treacher Collins (TC) syndrome affects 1 out of 50,000 live newborn babies (Trainor, J. Dixon, & M. J. Dixon, 2009). Most children with TC have facial irregularities, cleft palate, and bilateral aural atresia, typically resulting in severe bilateral conductive hearing loss. Airway management and nutrition are usually the most pressing issues at the beginning of life (Thompson, Anderson, & David, 2009). Often, children with TC are candidates for bone conduction hearing aids, which are worn on a soft headband until age 5 years. After the age of 5, many children with TC are eligible for bone-anchored hearing aids (Bahas). TC does not affect cognition; however, facial anomalies, cleft lip/palate, and aural atresia can significantly affect speech and language development. Intense speech and language pathology services are usually recommended (Thompson et al., 2009).

CHARGE Syndrome

The acronym *CHARGE* stands for *c*oloboma of the eye, *h*eart defects, *a*tresia of the choanae (nasal passages), *r*etardation of growth and/or development, *g*enital and/or urinary abnormalities, and *e*ar abnormalities. CHARGE syndrome occurs in every 9,000–10,000 births and is the second most common condition to affect both hearing and vision. Complex heart defects, swallowing, and breathing difficulties often initially overshadow educational issues related to hearing loss, vision loss, or cognitive delay (Raqbi, Le Bihan, Morisseau-Durand, Lyonett, & Abadie, 2003). Children with CHARGE syndrome are considered medically fragile, as multiple surgeries and ongoing medical care are frequently necessary. Most people with CHARGE syndrome have profound mixed or sensorineural hearing loss and a reduction in their visual field (Arndt et al., 2009).

Because the combination and severity of CHARGE characteristics vary, no one set of interventions is standard. Braille is not typically indicated in children ages 0–3 years; however, caregivers should know that most children with CHARGE eventually use large print and/or Braille. In addition, because 25%–50% of children with CHARGE have cognitive delay (Raqbi et al., 2003), early interventionists should pay particular attention to developmental milestones.

Autism Spectrum Disorder

Almost 1.5% of children in the United States have ASD (Baio, 2010). Due to conditions that can cause both hearing loss and ASD (e.g., rubella embryopathy), the prevalence of ASD is higher in the DHH population (Szymanski, Brice, Lam, & Hotto, 2012). Characteristics historically attributed to hearing loss, such as delayed speech and language, may mask behaviors associated with ASD (Roper, Arnold, & Monteiro, 2003). Consequently, ASD is commonly diagnosed later in children who are DHH than in children with typical hearing (Jure, Rapin, & Tuchman, 1991; Roper et al., 2003).

While no literature specifically examines strategies used with children 0–3 years of age who are DHH with ASD, becoming familiar with established EI techniques used with children with ASD would be helpful in providing effective service to this population. These techniques include comprehensive behavioral treatment for young children, language production intervention, naturalistic teaching strategies, and parent training (National Autism Center, 2015).

Infections That Cause Hearing Loss and Disabilities

Meningitis

Meningitis, an infection that can be viral or bacterial, is an acute inflammation of the membranes around the brain and spinal cord. Infants who contract meningitis are 10 times more likely to have a moderate or severe disability than infants who were never infected. Meningitis can cause learning difficulties, neuromotor disabilities, seizure disorders, visual disorders, and behavioral problems. In addition, a quarter of infants who survive meningitis experience hearing loss (Bedford et al., 2001). Interventionists and caregivers should closely monitor cognitive milestones, even though learning difficulties may not be evident early in life.

Cytomegalovirus

Cytomegalovirus (CMV) is a common virus that can affect development. A woman who contracts CMV during pregnancy, particularly if she is pregnant for the first time, can transmit the virus to her fetus. In 15%–20% of these cases, the virus can affect vision, hearing, cognitive development, and/or coordination (Goderis et al., 2014). Some babies asymptomatic at birth will later become DHH (Pass & Anderson, 2014). Professionals and the families of children who are DHH as a result of

CMV should be aware of the possibility of progressive hearing loss as well as potential motor and cognitive delays. Motor delays may warrant occupational and/or physical therapy services; a developmental specialist can offer insight into best practices for cognitive delay.

Changes in the Field

Policy changes such as implementation of EHDI and NBHS have dramatically increased the number of infants and toddlers who are DWD needing and receiving EI services. At the same time, demographic shifts in the DHH population have increased the complexity of educational and service needs of many young children who are DHH. Technological advancements have increased access to sound and language, while the declining number of deaf education teacher preparation (DETP) programs has had an impact on the number of teachers qualified to serve this diverse population. Taken together, these changes have reshaped the landscape of the field of deaf education in recent years.

Technology

Advances in technology such as digital hearing aids and cochlear implants (CIs) have provided children who are DHH greater access to sound than ever before. Modified criteria issued by the U.S. Food and Drug Administration now allow infants to receive CIs at age 12 months (Li, Bain, & Steinberg, 2004). Generally, infants 12 to 24 months of age must have a profound sensorineural hearing loss bilaterally to qualify as a candidate for a CI. Prior CI candidacy criteria, which included a minimum age of 2 years, routinely considered the existence of a disability as a contraindication for implantation. Early implantation approval, at 12 months or earlier, when medically necessitated, may preclude the ability of professionals to determine the presence of many disabilities.

The heterogeneity of the population of children who are DWD makes generalizing about the efficacy of cochlear implantation difficult. Evaluations of CI efficacy with children who are DWD typically involve speech perception and production measures. Language development tends to be more affected by the severity of the disability than the degree and onset of hearing loss; children who have less significant disabilities often realize greater oral language development, regardless of the level of their hearing loss (Edwards, Frost, & Witham, 2006; Waltzman, Scalchunes, & Cohen, 2000). Similarly, oral language development tends to occur at a slower pace and at lower levels for children who are DWD, when compared to peers who are DHH (Waltzman et al., 2000).

Qualitative measures of CI efficacy in children who are DWD have also been considered. These assessments, based on parent reporting, discuss efficacy in terms of awareness of the environment, appreciation of music, greater interest in communication, and changes in temperament as indicators of positive outcomes (Wiley, Jahnke, Meinzen-Derr, & Choo, 2005; Zaidman-Zait, Curle, Jamieson, Chia, & Kozak, 2015). Longitudinal studies are needed to further investigate qualitative lifespan changes (Donaldson, Heavner, & Zwolan, 2004).

In a limited study among parents of children who were DWD with CIs, 100% percent of respondents reported that they would repeat the decision to seek cochlear implantation for their child, considering both the quantitative and qualitative efficacy of implantation (Wiley et al., 2005). Given the range of outcomes and the young age of candidates for cochlear implantation, however, it is critical for EI specialists to provide families with accurate counseling (Hamzavi et al., 2000). Discussion should include information regarding speech and language development, CI management, and the potential impact of a disability on CI outcomes.

Deaf Education Teacher Preparation

One of the most significant challenges facing the field of deaf education is the shortage of teachers qualified to meet the needs of students who are DHH (Johnson, 2004; LaSasso & Wilson, 2000). This shortage is predicted to worsen as the number of DETP programs declines (Johnson, 2013). The lack of qualified personnel is particularly apparent in EI deaf education (Houston & Stredler-Brown, 2012), and has been exacerbated in recent years by the increase in the size of the population needing services as a result of NBHS and EHDI. Lack of qualified personnel is the most frequently cited reason for failure to provide children and families with timely EI services (National Early Childhood Technical Assistance Center, 2012).

DETP programs have not evolved in response to the demographic changes in the population of children who are DHH. The *American Annals of the Deaf* publishes an annual list of university and college programs for personnel in deafness, and DeafEd.net provides a catalog of DETP programs. The information included in each of these lists is self-reported. As of June 2015, DeafEd.net listed 64 DETP programs in the United States, although 5 were listed as no longer accepting students. Of the 59 programs still accepting students, 7 indicated that they offered programs or degrees in EI or that they had "Early Childhood" (EC) accreditation from the Council on Education of the Deaf. Only one of the programs listed on DeafEd.net indicated that it had "Multiple Disabilities" accreditation from CED (Gallaudet University), and none included program or degree descriptions that include both EC/EI and DWD ("Deaf Education Teacher Preparation Programs," n.d.).

Theory

Critical age theory (Lenneberg, 1969) remains a seminal guiding principle regarding the efficacy of EI for infants and toddlers who are DHH or DWD. With EI services for these children having shifted in recent years to an emphasis on the role of parents/caregivers (Bailey et al., 2006; Moeller, Carr, Seaver, Stredler-Brown, & Holizinger, 2013; Turnbull et al., 2007), tenets of family-centered theory (Bamm & Rosenbaum, 2008) are necessary to create beneficial learning environments. Moeller et al. (2013) describe family-centered intervention as a "flexible, holistic process that recognizes families' strengths and natural skills and supports development while promoting the following: (a) joyful, playful communicative interactions and overall enjoyment of parenting roles, (b) family well-being, (c) engagement, and (d) self-efficacy" (p. 430). To create nurturing intervention relationships, professionals must consider adult learning theories (Bodner-Johnson, 2001) with clearly defined outcomes (Moeller et al., 2013; Turnbull et al., 2007). Adult learning theory (Knowles, 1970) is concerned with differences between mature and child learners, while learning style theory (Kolb, 1984) addresses specific learning strategies of adults. Professionals must also recognize needed family supports to facilitate the impact of parent/caregiver interventions (Ingber, Al-Yagon, & Dromi, 2010; Turnbull et al., 2007). Particularly relevant theories associated with intervention are listed in Table 1.

Research

Disabilities such as learning disabilities (LDs), attention deficit disorder/attention deficit hyperactivity disorder (ADD/ADHD), and emotional and behavioral disorders are typically not diagnosed before the age of 3 years. While there is a paucity of research that focuses on infants and toddlers who are DWD, the literature does include explorations of issues related to students above the age of 3 who are DHH with LDs (e.g., Marlowe, 1991; Morgan & Vernon, 1994; Soukup & Feinstein, 2007; Stryker, 1998; Van Vuuren, 1995), with ADD/ADHD (e.g., Kelly, Forney, Parker-Fisher, & M. Jones, 1993a, 1993b), and with emotional and behavioral disorders (e.g., C. Roberts & Hindley, 1999). The findings of these articles are summarized in Table 2.

Conducting research related to children who are DWD presents a challenge, given the high level of diversity among this population. While more research is needed, the body of research that exists does provide information that can guide practitioners, researchers, and policymakers. Research related to identifying and addressing specific disabilities in children with typical hearing may be a valuable resource for educators serving students who are DWD. However, it is important to exercise caution when applying the findings of this research to students who are DHH or DWD. As noted in Table 2, issues related to communication, language

Table 1
Theories Associated With Intervention

Theory	*Links to practice*	*Modifications for infants who are DWD*	*Citation*
Critical age theory	Language acquisition occurs during early life; any needed remediation is most impactful before adolescence.	Intervention must begin early for maximum language development of an infant.	Lenneberg, E. H. (1969)
	Language development is the result of early interactions from which principles are derived.	As parents are an infant's primary language model, they must receive training/coaching to facilitate language.	Bamm, E. L., & Rosenbaum, P. (2008)
Family-centered theory	The focus is on the family as active participants in the intervention process.	The focus is the same, but with recognition of the additional needs associated with disability.	
Adult learning theory	Adults have different motivators for learning than those of children.	Differences in learning motivation encourage a collaborative versus a prescriptive model of intervention.	Knowles, M. S. (1970)
Learning style theory	In approaching learning, individuals express a preference for one of four distinct styles: diverging, assimilating, converging, or accommodating.	To coach effectively, interventionists should recognize the different learning styles of parents/caregivers.	Kolb, D. A. (1984)

Note. DWD = deaf with disabilities.

Table 2
Findings of Studies on Children Who Are Deaf With Disabilities

Disability category	*Findings*	*Citation*
Learning disabilities (LDs)	LDs can be identified in students who are DHH. Students with LDs exhibit short-term serial memory deficits regardless of hearing status. Students who are deaf or hard of hearing (DHH) and have an identified LD should have the same educational services as hearing students who have an identified LD.	Marlowe, B. A. (1991)
LDs	Eight categories of data should be collected when a student who is DHH is being assessed for LDs: case history, educational history, intellectual functioning, educational achievement, neuropsychological screening, adaptive behavior functioning and/or classroom behavior, audiological and vision evaluation, communication and language skills.	Morgan, A., & Vernon, M. (1994)
LDs	Half of surveyed teachers did not feel adequately prepared to teach students who are DHH and have LDs. Respondents wanted more training in identification, assessment, and intervention.	Soukup, M., & Feinstein, S. (2007)
LDs	Behaviors historically associated with LDs may be less accurate means of identifying LDs in students who are DHH. The finding of a discrepancy between IQ and achievement level was useful.	Stryker, D. S. (1998)
LDs	Existence of the majority of the following 10 characteristics could indicate the presence of an LD in a student who is DHH: (1) male, (2) older than same-class peers, (3) significant medical problems, (4) weak mother-child relationship, (5) weak scholastic achievement, (6) low motivation, (7) weak visual perception, (8) visual communication preference, (9) weak signing skills, (10) passive activity level/low concentration.	Van Vuuren, E. (1995, July)
Attention deficit disorder/ attention deficit hyperactivity disorder (ADD/ADHD)	The prevalence of ADD/ADHD in students who are DHH appears to be similar to that among students with typical hearing, but certain subgroups of children are at greater risk.	Kelly, D., Forney, J., Parker-Fisher, S., & Jones, M. (1993b)
ADD/ADHD	The authors present a model for implementing a school-based treatment program; management approaches are discussed for the classroom, home, and residential settings.	Kelly, D., Forney, J., Parker-Fisher, S., & Jones, M. (1993a)
Emotional and behavioral disorders	Issues surrounding the assessment and treatment of deaf children with mental health problems are explored (e.g., specific diagnostic categories, importance of communication, structure of the assessment team, collaboration across agencies).	Roberts, C., & Hindley, P. (1999)

delays, and practitioners' qualifications are among those that should be taken into account when a student who is DWD is being assessed or receiving services.

Practice

Identification and Assessment

Most infants and toddlers who are DHH are eligible for EI services through Part C of the Individuals With Disabilities Education Act. An infant or toddler who is DWD may also be eligible for additional EI services. Under Part C, many disabilities fall under the category of "Developmental Disability," which includes diagnosed delays or the risk of delay in cognitive, physical, communication, social or emotional, or adaptive development. It is estimated that 40%–50% of children with hearing loss are DWD (Cupples et al., 2014). Therefore, children who are DHH who are age 3 years or less should have their speech, language, and cognitive skills evaluated every 6 months (JCIH, 2007) to identify any potential delays or disabilities. Identifying disabilities as early as possible is essential to ensure that appropriate intervention can begin and positive outcomes can be maximized. As NBHS and EHDI help make communication delays less common in children with hearing loss, the diagnosis of disabilities such as ASD in children who are

DHH should, in theory, be easier than it has been in the past.

Assessments provide practitioners information needed for “screening, determining eligibility for services, individualized planning, monitoring child progress, and measuring child outcomes” (Division for Early Childhood, 2014, p. 7). Inherent in any assessment protocol for EI is the active involvement of parents/caregivers. The Division for Early Childhood (2014) identifies 11 assessment practices involving the family, a range of measures, and growth plans. These practices (e.g., “conduct assessments that include all areas of development and behavior to learn about the child’s strengths, needs, preferences, and interests; conduct assessments in the child’s dominant language and in additional languages if the child is learning more than one language,” p. 7) provide a framework from which specific evaluations can be selected.

Planning and Service Provision

While the labels associated with special education and EI services can provide important information to professionals working with children, focusing on the individual needs of children rather than on their categorical disability label is vital. Professionals who focus on categorical labels risk emphasizing the group characteristics associated with a particular label, rather than the unique strengths and needs of an individual child (Ewing & T. W. Jones, 2003). T. W. Jones (1984) has argued that programming decisions for students who are DWD should be based on the programming and activities that will develop the individual child’s abilities, rather than on a categorical label.

For students who are DWD, Ewing and T. W. Jones (2003) advocate that language acquisition be the foundation for placement and curriculum decisions. This assertion is particularly important to EI service providers, as early childhood is a critical time for language development. In addition, T. W. Jones and J. K. Jones (2003) argue that it is easier to incorporate special education practices into programs for students who are DHH than it is to incorporate the practices appropriate for the communication and language of a child who is DHH into a program for students with disabilities.

T. W. Jones, J. K. Jones, and Ewing (2006) detail assumptions that should be part of working with students who are DWD, including families’ critical role in success. In addition to using the transdisciplinary model, Ewing and T. W. Jones (2003) suggest using a person-centered planning approach with students who are DWD, reasoning that this approach to planning allows for services to be based on the needs and interests of the child. The use of person-centered planning allows for families to play a more central role in the planning and services provided to their child.

Collaboration Through a Transdisciplinary Model

EI services tend to include interdisciplinary teams; EI services for students who are DWD are no exception. EI services for children who are DWD typically involve multiple service providers, including teachers of the DHH, speech-language pathologists, and audiologists, and may include a range of other professionals, such as physical and occupational therapists, as well as the use of assistive technology, depending on the needs of the child.

In April 2014, the Division for Early Childhood of the Council on Exceptional Children published *DEC Recommended Practices in Early Intervention/Early Childhood Special Education*. These recommended practices include teaming and collaboration. While EI professionals typically feel that collaboration with families and other service providers is an important aspect of their work (McCollum & Stayton, 1996; Miller & Stayon, 1998), interdisciplinary collaboration can prove challenging (Miller & Stayton, 1999). One reason cited for this challenge is a lack of professional preparation for interdisciplinary collaboration (Bailey, Simeonsson, Yoder, & Huntington, 1990; Early & Winton, 2001; Mellin & Winton; 2003; Roush, Harrison, Palsha, & Davidson, 1992). In their qualitative examination of collaboration from practitioners’ perspectives, Smith and Leonard (2005) found that both inter- and intrapersonal value conflicts emerged as a theme among special educators. These types of challenges may be particularly common in the field of deaf education, given its long history of division and disagreement. Cook and Friend (2010) argue that collaboration is highly complex and subtle and merits explicit instruction for school professionals. Luckner and Carter (2001) include collaboration as both knowledge and a skill in their essential competencies for teachers of students who are DWD.

Ewing and T. W. Jones (2003) assert that four basic assumptions should be the foundation for planning related to children who are DWD: (a) every child can learn; (b) peer acceptance and social relations are essential for all students; (c) families are critical to success; and (d) service providers should implement and take advantage of the transdisciplinary model. In the provision of services to students with multiple special-learning needs, a continuum of collaborative models has traditionally been used: multidisciplinary, interdisciplinary, and transdisciplinary (Orelove & Sobsey, 1996). The multidisciplinary approach to collaborative service provision involves individual professionals working with children separately (Cloninger, 2004). The outcome of this model may be fragmented services and even conflicting activities and recommendations (Ewing & T. W. Jones, 2003). Using an interdisciplinary model, professionals communicate with each other and make decisions by consensus, but assessments and implementation tend to be conducted separately. This model does not allow for service providers to maximize coordination of their activities. In addition, it often results in one child working with multiple professionals, which may be difficult for young children (Cloninger, 2004).

The transdisciplinary model includes not only communication among service providers and families, but also the transfer of skills from one team member to another (Cloninger, 2004). Transdisciplinary collaboration is also known as the indirect therapy model and is characterized by planned role release, in which roles and responsibilities are shared and exchanged among team members (Giangreco, Prelock, Reid, Dennis, & Edelman, 2000). This model allows for a smaller number of professionals to be the primary service providers while the other members of the team act as consultants (Cloninger, 2004), an arrangement that may prove less stressful for young children.

Telepractice

In recent years, NCHAM created a "learning community" (including professionals from a total of five deaf education EI programs, one of which served children with developmental delays or other disabilities) to explore the potential of distance technologies as a means of providing EI services to young DHH children and their families. The participants in the learning community coined the term "tele-intervention," based on the telehealth models used in the medical community, and developed a guide for the use of tele-intervention for EI services for children who are DHH (NCHAM, 2014). The organizers of the NCHAM learning community made an effort to identify EI programs providing tele-intervention services that used communication methodologies such as sign language, Total Communication, or Simultaneous Communication, but no programs utilizing these communication approaches were identified (NCHAM, 2014). There is a need for efforts related to the provision of EI services for families who choose to use sign language or other manual communication modalities.

Center-based EI for children who are DWD may not always be accessible to families. Telepractice has facilitated service provision by providing "the application of telecommunications technology at a distance by linking clinician to client, or clinician to clinician, for assessment, intervention, and/or consultation (American Speech and Hearing Association, n.d.). Although service delivery strategies that utilize technology such as videoconferencing and other types of web-based two-way communication are relatively new and need further investigation (Houston & Stredler-Brown, 2012), telepractice is associated with positive outcomes (Blaiser, Behl, Callow-Heusser, & White, 2013; Houston, 2011; McCarthy, Muñoz, & White, 2010). In addition, the use of telepractice to provide EI services supports a more family-centered approach than those provided in person. Because the service provider is not physically present in the room, the family member(s) must take an active role in interacting with the child while the service provider acts as a "coach," instead of the family member(s) observing while the service provider actively engages with the child. This dynamic allows the family member(s) to become more proficient and confident in the techniques used by service providers (Houston & Stredler-Brown, 2012).

Tele-intervention services can provide children and their families with access to qualified providers, decrease travel-related challenges, reduce cancellations, and increase access to interpreters (NCHAM, 2014). At the same time, it is important to note some of the potential challenges to providing services via technology. Privacy is a concern that must be addressed whenever technology is being used to work with children and families. In addition, it may not be easy for all families to access a high-quality Internet connection or the necessary equipment. Even in situations in which technology and connectivity are readily available, it cannot be taken for granted that families and professionals will all be comfortable with these tools.

Teacher Preparation for DWD EI

The JCIH (2007) advises that EI services should be provided by a professional trained to meet the specific needs of a child who is DHH. To provide appropriate services to children who are DWD, professionals need to be well informed not only about a wide range of disabilities, but also about the ways in which disabilities interact with hearing loss to create a compounded, complex set of needs. It would be impossible for individual professionals to be expert in every type or combination of disabilities they could expect to encounter in their careers. Therefore, professionals must rely on collaboration (Ewing & T. W. Jones, 2003). Because disabilities may be diagnosed as a child grows and develops, EI personnel working with children who are DWD need to be prepared to be a part of the ongoing diagnostic process. In addition, professionals should be aware that the diagnosis of a disability might be difficult for parents of infants and toddlers who are DHH to accept (T. W. Jones & J. K. Jones, 2003; Meadow-Orlans, 1995). Professionals should be prepared to provide the higher levels of emotional and logistical support young children who are DWD and their families may require (T. W. Jones & J. K. Jones, 2003).

Researchers have noted the need for teacher preparation programs to provide more information and training on children who are DWD (Bruce et al., 2008; T. W. Jones & J. K. Jones, 2003; Luckner & Carter, 2001). Although they do not specifically state that this training should be geared toward DWD EI, their suggestions could be applied to the population of students who are ages 0–3 years and DWD. The rapidly changing demographic diversity of children who are DHH, the shortage of professionals with expertise related to hearing loss, and the lack of specialized services for children who are DWD are challenges to future development of strong EHDI programs (JCIH, 2007). Given the current demographics and projections for the future, professionals providing EI services to children who are DHH need to be prepared to meet the needs of young children who are DWD and their families. DETP programs and professional development are both critical components of this preparation.

Cultural Competency

Rosen (2000) conducted a survey of the Deaf community to gain its members' perspectives on early hearing detection and intervention. One of the findings of the survey was a recommendation that early detection and EI be made "deaf-friendly" and avoid "over-medicalization" of hearing loss by involving individuals who are D/deaf in the process. When forming transdisciplinary teams to provide EI services to children who are DHH, professionals should ensure that families have the option of involving adults who are DHH. If adults who are DHH and/or individuals from the Deaf community are included on transdisciplinary teams serving young children who are DWD, the children and their families may benefit from interacting with a D/deaf adult and the presence of a D/deaf role model for the child.

The Deaf Mentor Experimental Project, conducted at Utah State University, compared young children who were DHH and received regular visits from deaf adult "mentors" with their peers whose EI services did not include a deaf mentor. The results showed that children with a deaf mentor had better outcomes in expressive and receptive language, more advanced English grammatical structures, and larger vocabularies than children who did not have a deaf mentor (Watkins, Pittman, & Walden, 1998). While this was a small study, and did not focus on children who were DWD, it demonstrates the potential benefits of including a D/deaf adult on transdisciplinary teams for infants and toddlers who are DWD.

Because children who are DWD may be less likely to be considered part of the Deaf community, these children and their parents may have fewer opportunities to be exposed to D/deaf adults and D/deaf role models (T. W. Jones & J. K. Jones, 2003). This could make the inclusion of D/deaf adults even more important for infants and toddlers who are DWD and their families.

Conclusion

The number of children who are DWD has grown significantly. Advances in early identification, amplification, and best practice models allow infants and toddlers who are DWD to realize increasingly positive outcomes. In order to maximize the benefits of these advances, DETP programs need to prepare EI teachers to meet the needs of children who are DWD. Effective educational programming for young children who are DWD should be highly flexible and individualized (Pronovost et al., 1976), with EI services that are both child centered and family centered (T. W. Jones & J. K. Jones, 2003). A transdisciplinary approach to serving infants and toddlers who are DWD and their families allows for highly coordinated services based on input from a team of professionals with a diversity of experience and expertise.

Professionals face challenges related to timely provision of EI services due to a shortage of qualified individuals who have the skills to meet the unique needs of the DWD population. Although more research is needed, use of technologies such as telepractice may be one way to address this need. Recent trends in DETP programs and professional development include distance learning components and the use of web-based resources (Johnson, 2004; Stryker, 2011). The use of technologies similar to those used in teleintervention in teacher preparation and in-service learning may alleviate the critical shortage of service providers with training specific to the needs of infants and toddlers who are DWD. These same telepractice and distance learning technologies could also be used as a platform for facilitating transdisciplinary collaboration.

As the population of children who are DHH becomes increasingly diverse, professionals who provide EI services to this population will require pre- and in-service training that is focused on evidence-based practices. The positive changes brought about by early diagnosis and technological advancements make it all the more imperative that the field of EI deaf education increase the availability of qualified professionals and effective practices available to meet the needs of infants and toddlers who are DWD. While conducting research related to children who are DWD presents a challenge, practices such as tele-intervention and transdisciplinary teams hold promise and warrant further investigation.

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