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Prelinguistic Development and Intervention in Children with Down syndrome

Whitney McDermott

Southern Illinois University Carbondale, wamcderm@gmail.com

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PRELINGUISTIC DEVELOPMENT AND INTERVENTION IN CHILDREN WITH DOWN
SYNDROME

by

Whitney A. McDermott
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Submitted in Partial Fulfillment of the Requirements for the
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A Research Paper Submitted in Partial
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in the field of Communication Disorders and Sciences

Approved by:

Dr. Kenneth O. Simpson, Chair

Dr. Valerie E. Boyer

Graduate School
Southern Illinois University Carbondale
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Introduction

Down syndrome is a genetic condition caused by the presence of an additional 21st chromosome (trisomy 21) or a part of that chromosome (translocation). In the United States alone, Down syndrome occurs in 13.65 per 10,000 live births per year (Roberts, Price, & Malkin, 2007) and is the principal genetic anomaly for learning disabilities (Abbeduto, Warren, & Conners, 2007; Roberts et al., 2007). This condition is associated with psychomotor and cognitive impairments that affect language learning. The typical sequence of language development consists of two stages: prelinguistic and linguistic. The prelinguistic stage consists of the use of gestures, imitation, and babbling (Roberts et al., 2007). Additionally, the linguistic stage consists of various components such as semantics, syntax, phonology, and pragmatics (Roberts et al., 2007). This research paper will review literature about birth to four-year-old children with Down syndrome in order to identify how this population develops pre-linguistic skills and how to effectively intervene to increase their language development.

Traits of Down syndrome

Individuals with Down syndrome have muscular, nervous, and skeletal systems that vary from those without Down syndrome. Some of these abnormalities include hypotonia, stunted growth, reduced brain size and weight, differences in the central and

peripheral nervous system, and dysmorphic facial features (Roberts et al., 2007; Stoel-Gammon, 2001). Cognitive deficits are also apparent in individuals with Down syndrome with varying degrees of severity from mild to severe learning disabilities. Of this population of individuals with Down syndrome, between 70 and 75% of these individuals have an intelligence quotient (IQ) between 25 and 50 (Rihtman, Tekuzener, Parush, Tenenbaum, Bachrach & Ornoy, 2009). This confirms the research conducted by Abbeduto et al. (2007) that most individuals with Down syndrome have an IQ between 30 and 70. Individuals with Down syndrome experience a reduced life expectancy than typically developing individuals (Rihtman et al., 2009).

Hearing and abnormalities in oral-motor structures, which may contribute to problems in language development, are two additional characteristics commonly associated with Down syndrome. Children with Down syndrome often experience recurring periods of otitis media, a middle ear infection, because of their physical anomalies and immune deficiencies (Roberts et al., 2007). Otitis media is often accompanied by fluid in the middle ear which can cause mild to moderate hearing loss (Roberts et al., 2007). According to Roberts et al. (2007), otitis media commonly does not affect language learning in typically developing children; however, children with Down syndrome are more susceptible to language learning deficits due

to otitis media. An additional trait that may hinder language development in individuals with Down syndrome is their oral structure. These structural and functional differences are thought to affect their speech production (Roberts et al., 2007). Even though these differences may vary among individuals with Down syndrome, they may include small oral cavity, a narrow-high arched palate, irregular dentition, and an enlarged protruding tongue (Roberts et al., 2007). Because of their differences in the central and peripheral nervous system, the muscles of the face are abnormal, which is another factor that may decrease overall speech intelligibility (Roberts et al., 2007).

Prelinguistic Development in Typically Developing Children

Before children are able to communicate with verbal language, they relay messages with their caregivers through gestures, vocalizations, and attentional patterns. Attentional patterns are imperative pre-linguistic skills for language development.

In typically developing infants, attentional skills develop in a sequential order during their first and second years of life. Bakeman and Adamson (1984) observed the development of joint attention in two groups of typically developing infants aged six-12 months and 12-18 months. These two groups of infants were observed in their homes where they interacted with their

mother and a same-aged peer. All the trends observed within this study were similar regardless of partner. At six months of age, infants visually examine objects or people and begin to interact with their immediate environment (Bakeman & Adamson, 1984). Between six and nine months, infants develop passive attentional skills where the infant and caregiver share objects, but the infant is unaware of the caregiver's presence (Bakeman & Adamson, 1984). Coordination of attention between the infant, caregiver, and object begins between nine months and one year (Bakeman & Adamson, 1984). At this stage of their life, infants are beginning to engage in triadic interactions (interactions between self, other, and object). As infants mature, their interaction skills become increasingly more complex. They utilize eye contact, gestures, and vocalizations to request help from acquiring items from their caregivers (Bakeman & Adamson, 1984; Legerstee & Weintraub, 1997).

Joint attention, the most common attentional pattern, influences children's language development. Landry and Chapieski (1989) defined joint attention as the co-occurrence of looking to the same object by both the infant and caregiver. These triadic interactions serve as the foundation of early pragmatic development. It requires more demands on the infant's attentional capacity than that of individual play. Also, joint attention is the foundation of a child having the ability to

learn from social interactions (Bakeman & Adamson, 1984). According to Tomasello and Farrar (1986), the caregiver's language within episodes of joint attention is associated with an increase in vocabulary growth in children. Mothers who do not engage in joint attention have children with decreased vocabulary (Tomasello & Farrar, 1986). Joint attention allows children to understand the meaning between words and objects.

Prelinguistic Development in Children with Down syndrome

Joint Attention

Developmental disorders such as Down syndrome may disrupt the direct relationship between joint attention and language development. Legerstee and Weintraub (1997) examined two groups of infants, one with and one without Down syndrome, on their ability to share attention with people over objects. Within each group, infants were divided into two cohorts. Each cohort consisted of infants with a high and low mental age. Infants with the mental age below 12 months were included in the low mental age group— 6.0–11.0 months for infants with Down syndrome and 6.5–11.0 months for typically developing infants (Legerstee & Weintraub, 1997). Infants with the mental age equivalent or above 12 months of age were included in the high mental age group— 12.0–20.5 months for infants with Down syndrome and 13.0–21.5 months for typically developing infants (Legerstee & Weintraub, 1997). In this longitudinal study over an eight month

time period, each infant was observed playing with a peer, their mother, and the peer's mother.

Results of this study indicate that coordination of attention increased with development in individuals with and without Down syndrome. Typically developing infants increased their time spent in joint attention by 27% whereas infants with Down syndrome increased their time by 15% (Legerstee & Weintraub, 1997). Even though both groups displayed similar patterns, infants with Down syndrome produced less coordinated attention and progressed at a slower rate. Their ability to coordinate attention to their mother was significantly less than those without Down syndrome. Over the eight-month period, infants with Down syndrome increased their ability to coordinate attention to their mother by 10% whereas infants without Down syndrome increased by 45% (Legerstee & Weintraub, 1997). Infants with a higher mental age increased their time in coordinated attention in both groups substantially more than infants with a lower mental age.

This finding is inconsistent with the research completed by Harris, Kasari, and Sigman completed in 1996. Harris et al. (1996) designed their study to examine joint attention and topic initiations in caregiver-child interactions in infants with and without Down syndrome. They believed that the amount of time a caregiver and child spend in joint attention would provide the

child with more opportunities to comprehend the meaning of words. This study consisted of 28 children with Down syndrome with mental ages between nine and 27 months and 17 children with typical development. To target this relationship, Harris et al. (1996) observed interactions of toddlers with Down syndrome and typically developing with their caregivers in a laboratory playroom. The children were allowed to explore the laboratory along with a basket full of toys for 12 minutes of solo play. After solo play, they examined five minutes of child-caregiver interaction with a new set of toys. They found a significant difference in the amount of time children with Down syndrome and their caregivers spend in joint attention as compared to typically developing children and their caregivers. On average, children with Down syndrome and their caregivers spent 20% more time in joint attention than their typically developing peers (Harris et al., 1996).

Not only did Harris et al. (1996) study joint attention, they also observed how topic initiations along with joint attention might affect language development. In order to be coded as a topic, the child had to be reaching for, touching, or utilizing an object (Harris et al., 1996). They observed that the caregivers of children with Down syndrome maintained more attention to caregiver-selected toys than did caregivers of typically developing children. Thus, caregivers of children with

Down syndrome were more likely to control the topic of play. These children with Down syndrome, 13 months later, demonstrated lower receptive language skills than those individuals with Down syndrome whose caregiver maintained attention to toys they selected (Harris et al., 1996). This outcome may be critical for caregivers who want to increase language development. According to Bakeman and Adamson (1984), attentional demands are minimized when the caregiver follows the child's lead. In order to increase receptive language skills, it is imperative that caregivers who have children with Down syndrome maintain attention for longer periods of time and to the toys their children select.

This finding is comparable to other researchers who have found children with Down syndrome have difficulty shifting the focus of their attention (Kasari, Freeman, Mundy, & Sigman, 1995; Landry & Chapieski, 1989). Cognitive demands are increased when children shift their focus because they are relying on their receptive language skills (Harris et al., 1996). Thus, the more a child with Down syndrome is redirected to a new object, the fewer opportunities the child has to focus on the language that is taking place during the interaction. Redirecting attention away from child-selected toys may result in the child not having the ability to comprehend the meaning between words and objects.

Social Referencing

Joint attention in triadic situations have normally been conducted in positive situations, "where the object or event becomes the topic of communication and looks to the person are viewed in light of 'information sharing' or 'sharing looks'" (Kasari et al., 1995, p. 129). Kasari et al. (1995) studied social referencing in infants with Down syndrome and typically developing infants. Social referencing refers to how infants respond to their caregiver's emotional response in triadic interactions. For example, if the infants observe a fearful look upon the adult's face when they are reaching for an object, the infants are less likely to grab that object. If infants observe an excited look upon the adults face, they will be more likely to reach for the object. Infants then use these emotional responses to form their own responses to events. This process differs from joint attention in that infants are "seeking information" rather than "sharing information" (Kasari et al., 1995, p. 129). Social referencing, in theory, is more demanding to an infant's attentional system because it requires the infant's ability to process the adult's emotional message.

Kasari et al. (1995) hypothesized that infants with Down syndrome would engage in fewer social referencing looks than typically developing infants because of the higher demands it has on the infant's attentional system. In order to test this

hypothesis, Kasari et al. (1995) introduced a remote-controlled robot to the infants. When the robot moved forward, the experimenter and parent demonstrated expressions of fear or joy upon seeing the robot. The frequency in which infants with Down syndrome demonstrated social referencing looks between the robot, the parent or experimenter was less than typically-developing infants. Because the frequency of social referencing looks was less than typically developing infants, Kasari et al. (1995) examined latency to shift attention. Hypotonia is typical in individuals with Down syndrome, and therefore, may hinder their performance. This, in turn, would provide them less time make the same number of attentional shifts than typically developing infants (Kasari, et al., 1995). They observed the latency of shifting attention between the robot and person was similar with both groups.

These results suggest that children with Down syndrome are less likely to comprehend the situation in social referencing procedure, possibly due to them being unable to make the connection between the emotional message of the caregiver and the stimulus presented (Kasari et al., 1995). Another possible reason for the differences between shifting attention among the groups is that children with Down syndrome showed a preference for active, expressive faces (joy) rather than those of fear (Kasari et al., 1995).

Nonverbal Communication

Children typically begin to communicate using gestures before using words. By the end of their first year, children utilize gestures to draw attention to their communicative partner to objects or people within their environment (Zampini & D'Odorico, 2011). Investigations on gestural production in children with Down syndrome have been widely studied. These children have strength in production of gestures compared to typically developing children. Children with Down syndrome prefer the use of gestures to vocal productions and have a wider gestural inventory than typically developing children (Zampini & D'Odorico, 2011). Iverson, Longobardi, and Caselli (2003), on the other hand, concluded that children with Down syndrome produce similar amounts of gestures as their typically developing peers.

Zampini and D'Odorico (2011) aimed to describe the relationship between language development and gesture production in eight, two-year-old children with Down syndrome. Children's gestural and verbal productions were assessed during mother-and-child play sessions over three sessions across a three-year time period. The communicative gestures produced by the children in these sessions were categorized into pointing, showing, conventional gestures, and iconic gestures. Pointing refers to the child extending the index finger in the direction of a

person or object. Showing, on the other hand, occurs when the child holds up an object within the caregiver's line of sight. Conventional gestures include gestures that have a culturally defined meaning whereas iconic gestures refer to objects or persons reproducing their physical or functional characteristics (Zampini & D'Odorico, 2011). For example, a conventional gesture would be children nodding their head to indicate "yes". Children putting a hand to their head to indicate a "hat" is a prime example of an iconic gesture.

They concluded that some children showed an increase in gesture production between 24-months and 48-months (Zampini & D'Odorico, 2011). Another group of children, on the other hand, demonstrated a decrease or stability in gestural production during this time period. These children, however, showed a growth in lexical development as well as higher frequency of word productions (Zampini & D'Odorico, 2011). This confirms the research completed by Iverson et al. (2003) that children with Down syndrome utilize gestures to compensate for their difficulties in verbal productions. When there is an increase in their vocabulary repertoire, the use of gestures decreases. Gesture production is a reliable indicator of later vocabulary in children who are 24 and 36 months old (Zampini & D'Odorico, 2011).

Parental Stress and Language Development

Parents and their children with developmental disorders can influence one another. Parents who have children with developmental disorders, such as Down syndrome, often perceive their child as different from other children. They begin to mourn the idea that their child will never be "normal" and may not take pleasure in their child (Brinker, Seifer, & Sameroff, 1994). For example, finding family activities that are appropriate and entertaining for all members may be more difficult with families who have a child with a disability. These parents who have a child with a disability reported more health problems, negative attitudes, greater overprotection, and an increase in time demands (Brinker et al., 1994). Their increased level of stress may have resulted from the initial diagnosis of their child. Skotko and Bedia (2005) documented the reflections of 467 mothers who received a postnatal diagnosis of Down syndrome for their child. According to most mothers, they felt frightened, anxious, guilty, angry, and in some cases, suicidal (Skotko & Bedia, 2005). They reported that their physicians did not supply enough information on Down syndrome, whether verbally or printed materials, and made the proper referrals to support groups and services (Skotko & Bedia, 2005).

Children with developmental delays may be recommended for early intervention services. A multidisciplinary team including

speech and language pathologists, physical therapists, occupational therapists, social workers, or special education providers help families facilitate development of children with developmental disorders. Intervention can have varying effects on development and family stress. On one hand, parents may feel relieved that they are receiving help from a variety of experts (Brinker et al., 1994). On the other hand, they may feel overwhelmed due to expense and varying schedules (Brinker et al., 1994).

Brinker et al. (1994) studied the relations among maternal stress, cognitive development, and early intervention in infants with developmental disabilities with both low and middle class social economic status ("SES"). Highly stressed, low class families whose infants had higher attendance in early intervention services had the same developmental outcomes as highly stressed low-class families who did not regularly attend early intervention services (Brinker et al., 1994). However, middle SES families whose infants attended early intervention more often demonstrated a substantial increase in development compared with their counterparts who did not frequently attend services (Brinker et al., 1994). Involvement in more early intervention programs leads to an increase in stress in all families (Brinker et al., 1994). This increased level of stress may be caused by higher caregiving demands these disabilities

place on parents rather than the disability itself (Brinker et al., 1994). It is imperative that each individual family along with their intervention team develop a plan that is not only beneficial for their children but for the entire family (Brinker et al., 1994). Early intervention has attempted to make a system that is more family and support focused since 1994 by utilizing parent-oriented interventions such as the Hanen Early Language Parent Program and Responsitivity Education/Prelinguistic Milieu Teaching (RE/PMT).

Treatment

Prevention

Because individuals who have Down syndrome have frequent middle ear infections caused by their physical anomalies, it is imperative to conduct regular hearing screenings to prevent further language delays (Roberts et al., 2007). Roberts et al. (2007) found that children with Down syndrome should have their hearing tested when otitis media persists for three months or longer. When children have otitis media for more than four months, the placement of tympanotomy tubes is recommended (Roberts et al., 2007). Their speech and language should be monitored at all times while their otitis media is medically treated (Roberts et al., 2007). According to Roberts et al. (2007) adapting the child's learning environment to include

hearing aids or other amplification systems is beneficial because hearing is an important factor in language learning.

Early Intervention

Early intervention provides knowledge and suggestions on social interactions to families who have children with developmental delays. The overall goal is to “foster, facilitate, and optimize interactions between children with Down syndrome and their carers and other social partners and, thus, build social, affective, and cognitive development in the child as well as family wellness (Iarocci, Virji-Babel & Reebye, 2006, p. 12). Since children with Down syndrome are identified before or shortly after birth, they are eligible to receive early intervention during their first year of life (Abbeduto et al., 2007). Evidence shows the importance of early intervention during the first few months of life for individuals with Down syndrome (Roberts et al., 2007). Infants who receive intervention within their first month of life, rather than three to six months later, demonstrate significant gains in overall language scores (Roberts et al., 2007).

Multiple studies indicate parent-oriented interventions have increased prelinguistic and early linguistic skills in individuals with Down syndrome (Roberts et al., 2007). Not only do these interventions have positive outcomes for developmentally delayed children, studies have found a positive

change in parental behavior (Girolametto, 1988). Responsivity Education/Prelinguistic Milieu Teaching combines a parent-teaching approach and direct clinical intervention to individuals with developmental delays along with their families. PMT is an intervention for children with language delays who have limited or non-existent lexical inventory and significant difficulty with nonverbal acts (Fey et al., 2006). PMT is designed specifically to teach gestures, vocalizations, and coordinated eye gaze behavior within the child's natural environment (Fey et al., 2006). RE/PMT has been the focus of two longitudinal studies that have included subgroups of children with Down syndrome. The first study, by Yoder and Warren (2002), investigated the effects of 12 months of RE/PMT with 39 prelinguistic children with intellectual disabilities, including 17 children with Down syndrome and their caregivers. The PMT portion of the intervention was implemented three to four times a week for six months for 20 minutes per session. Parents were offered 12 education sessions for responsivity education. They concluded that RE/PMT resulted in no main effects on children; however, this treatment decelerated the rate of requests in children with Down syndrome (Yoder & Warren, 2002).

These results led Fey et al. (2006) to conduct a replication and extension of this study. In the Yoder and Warren (2002) study, clinicians typically followed child vocalizations

with a vocal imitation; however, Fey et al. (2006) followed the child's vocalizations by complying with them and linguistically mapping the referent (Fey et al., 2006). Also, they had trained speech-language pathologist implement PMT rather than a trained paraprofessional. A total of 51 children between the ages of 24-33 months, 26 with Down syndrome, participated in the study along with their caregivers. The intensity of the intervention differed than Yoder and Warren (2002). Parents of the children in the early intervention group were scheduled to receive eight, one hour individual sessions of RE. PMT sessions occurred four days per week in 20-minute sessions in the children's home or in their day care facilities. Results indicated that children who received RE/PMT produced more intentional communication than the control group. Children with Down syndrome responded positively to the intervention as their typically developing peers. Thus, this result indicates that RE/PMT as implemented by Fey et al. (2006) is an effective intervention program for children with Down syndrome.

The best-known parent-training approach for prelinguistic children is the Hanen Early Language Parent Program (Abbeduto et al., 2007). Speech-language pathologists teach groups of parents to promote turn-taking, model words and language, and create opportunities for communication with their child (Abbeduto et al., 2007). Girolametto (1988) investigated the effects of the

Hanen program on a group of mothers and children that included 11 children with Down syndrome. This treatment program lasted 11 weeks and consisted of eight group sessions along with three individual home visits. Each group visit lasted three hours during the evening so that both parents could attend. Children were only present during the home visits and assessment periods. Results indicated that children in the experimental group initiated more topics, had a more diverse vocabulary, and took more turns in conversation (Girolametto, 1988). However, there were no significant differences between the control and experimental groups in language development at post-testing. These studies demonstrate the positive correlation between early intervention and prelinguistic language development in children with Down syndrome.

Conclusion

Genetic disorders, such as Down syndrome, can have adverse effects on language development. Because Down syndrome is the leading genetic cause of intellectual disabilities, it is imperative these children receive early intervention from the time they are diagnosed (Abbeduto et al., 2007). It is important that speech-language pathologists understand how prelinguistic skills are typically developed; therefore, they can provide the best individualized care to individuals with Down syndrome.

Multiple studies that indicate parent-oriented interventions have increased pre-linguistic or early linguistic skills in individuals with Down syndrome (Roberts et al., 2007). Hanen Early Language Parent Program (Girolametto, 1988) and RE/PMT (Yoder & Warren, 2002; Fey et al., 2006) have shown promising results in language development in children with Down syndrome. However, they were all at a "low intensity" rate. Direct intervention with just the child was for only an hour per week for six months.

Further research investigations should examine how intensive intervention programs can help facilitate language development in individuals with Down syndrome. Also, more studies are needed to examine the variations in treatment intensities to determine the best intervention for these individuals. This lack of evidence-based research with this population limits speech-language pathologists' ability to provide evidence-based practice.

Prelinguistic development occurs in a specific pattern for typically developing children. Future research investigations should examine the development of prelinguistic skills in individuals with Down syndrome by completing more longitudinal studies across the lifespan of individuals with Down syndrome. There is inconsistent and contradicting research on how prelinguistic communication develops in individuals with Down

syndrome. Further research should examine the precise development of these skills in order to guide early interventionists on how to target these deficits.

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VITA

Graduate School
Southern Illinois University

Whitney McDermott

wamcderm@gmail.com

Purdue University
Bachelor of Science, Speech, Language, and Hearing Sciences, May
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