

Parent's Perspective about Intelligibility of Speech in Children with Cerebral Palsy

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ABSTRACT

Background: The term cerebral palsy (CP) refers to a collection of long-term abnormalities of posture and movement development that limit an individual's activities. These abnormalities are thought to be caused by non-progressive disruptions in the growing fetal or infant brain.

Aim: To identify the speech intelligibility of children with cerebral palsy with different communicative partners

Methods: This study employed convenient sampling over two months, conducted within the Pakistan Society for the Rehabilitation of the Disabled (PSRD) and Rising Sun Institute for Special Children. Data collection involved the ICS questionnaire, capturing parents' ratings on their child's speech intelligibility in various social contexts.

Results: Out of 119 participants, predominantly aged 4 to 12 years, the study revealed varying levels of speech intelligibility. Scores on the Intelligibility in Context Scale (ICS). Parents exhibited a high level of understanding, with a mean score of 4.32 ± 0.96 SD, signifying a substantial level of intelligibility. Immediate family members, extended family members, and the child's teachers also demonstrated relatively high mean scores, ranging from 3.91 to 3.87. In contrast, strangers had a markedly lower mean score of 2.94 ± 1.49 SD, indicating heightened challenges in comprehending the speech of children with cerebral palsy.

Conclusion: The speech of children with cerebral palsy is most easily understood by parents, while strangers encounter more significant challenges. This reinforces the crucial role of familiarity in shaping speech intelligibility for these children. The observed difficulties in communication with unfamiliar individuals emphasize the need for targeted interventions and support to address the unique challenges faced by children with cerebral palsy in diverse social contexts.

Keywords: Cerebral Palsy, Speech Intelligibility, Parental Perspective, Intelligibility in Context Scale (ICS)

INTRODUCTION

The term cerebral palsy (CP) refers to a set of permanent developmental conditions that restrict movement and posture, resulting from non-progressive damage to the developing brain of a fetus or infant. Disruptions in sensation, perception, cognition, communication, and behaviour are frequently present in conjunction with these physical ability limitations^{1,2}.

Communication is the process of exchanging information, ideas, thoughts, feelings or messages between individuals through various mediums such as speech, writing, gestures, body language, or signals³. It involves a sender who encodes a message and a receiver who decodes it. Effective communication requires both the sender and the receiver to understand the message in the same way, and feedback may be provided to ensure that the message was received accurately⁴. Good communication skills are essential in building relationships, expressing thoughts and feelings, and achieving common goals^{5,6}.

Communication can be challenging for children with cerebral palsy (CP) as both senders and receivers of messages. Motor disabilities can affect their ability to write with a pen or a computer, as well as their ability to speak and make gestures⁷. Cognitive deficits may cause delays in spoken and written language development, while visual impairments may affect interpersonal communication and language development⁸. Additionally, hearing loss can impact speech perception, language development, and spoken and written communication, while epilepsy can affect language and cognitive processes⁹. The restrictions imposed by these impairments, including reduced exposure to the outside world and limitations on activities, may further hinder a child's ability to communicate effectively¹⁰.

Communication challenges for individuals with cerebral palsy can affect different aspects of speech production, such as breathing, phonation, articulation, and nasality¹¹. Dysarthria, a

motor disorder commonly associated with cerebral palsy, can impact one or more of these areas and result in speech difficulties^{12,13}. These challenges can range in severity and may include difficulty articulating, speaking in a hyper-nasal tone, producing audible air through the nose while talking, having a low-pitched or harsh-sounding voice, irregular or shallow breathing, and struggling to articulate words^{14,15}.

Parents of speech-impaired children often express concern about reduced speech intelligibility. Speech intelligibility refers to how much of the phonetic realization of speech is understood by listener^{16,17}. Intelligibility is the result of a series of interactive processes involving phonation, articulation, resonance, and prosody^{18,19}. Other factors that can affect speech intelligibility include the nature of the spoken material, the context of communication, the listener's familiarity with the speaker, support for the message being conveyed, clarity of visual and acoustic signals of speech, and various environmental and linguistic factors²⁰. Due to the multiple variables involved, procedures for measuring speech intelligibility are not widely described, and speech-language pathologists rarely use them in practice²¹. Studies indicate that dysarthria, a speech motor disorder affecting one or more of the speech subsystems, may impact up to half of children with cerebral palsy (CP) and often results in reduced speech intelligibility^{22,23}.

Recent research suggests that even children with CP who do not have clinical dysarthria may experience delays in speech intelligibility development compared to their peers^{24,25}. Therefore, enhancing speech intelligibility is an important goal of treatment for individuals with CP and dysarthria and measuring speech intelligibility in a developmental context is crucial.

Conducting research on parents' concerns regarding their children's speech intelligibility and gaining a deeper understanding of speech intelligibility in children, particularly those with cerebral palsy, is crucial. This knowledge can help identify potential areas for intervention and support for both the children and their families. Quantifying the nature and degree of speech intelligibility in children with cerebral palsy can also provide valuable insights into

Received on 10-07-2023

Accepted on 20-09-2023

the condition and its effects on communication. Additionally, examining parents' perspectives on their child's speech intelligibility can help identify areas where additional support and resources may be necessary. Addressing the research gap in this field can result in improved evaluation, diagnosis, and treatment of speech impairments in children with cerebral palsy, as well as better support for their families.

Practical Implication: The use of the ICS as a measure of speech intelligibility can be helpful in identifying children who may need targeted interventions to improve their speech intelligibility. It is important to consider the individual needs of each child with CP and provide tailored interventions to support their communication development.

MATERIAL AND METHODS

The study has been observational and cross-sectional in nature, utilizing a convenient sampling technique for data collection over a period of 2 months. The research was conducted within the dynamic context of the Pakistan Society for the Rehabilitation of the Disabled (PSRD), a multifaceted institution comprising both a hospital and an educational facility. This unique setting allowed for a comprehensive exploration of the speech intelligibility of children with cerebral palsy. Data were collected from two primary sources within the institution—the school and the Outpatient Department (OPD). Additionally, insights were gleaned from the Rising Sun Institute for Special Children in Lahore, which served as another pivotal school setting. This diverse study area provided a rich tapestry of experiences, offering a nuanced understanding of how speech intelligibility manifests in the distinct social environments of healthcare and educational institutions dedicated to serving individuals with disabilities in Pakistan²⁶.

The assessment of speech intelligibility in children with cerebral palsy was conducted using the Intelligibility in Context Scale (ICS), a parent-completed questionnaire developed by McLeod, Harrison, and McCormack in 2012^{27,28}. The ICS comprises 7 items, and parents were actively involved in providing subjective ratings on a 5-point Likert scale. The questionnaire aimed to capture the degree to which the speech of children with cerebral palsy was understood by various communication partners, including parents, immediate family members, extended family, friends, acquaintances, teachers, and strangers over the previous month. The total score, calculated as the mean of all ratings, served as a comprehensive measure of speech intelligibility within different social contexts. The adoption of the ICS questionnaire in our study enriched the methodology by offering a nuanced perspective on the communicative effectiveness of children with cerebral palsy.

RESULTS

In this study out of 119 participants, 74(62.2%) were males and 45(37.8%) were females, with ages ranging from 4 to 12 years, a mean age of 7.29 years and a standard deviation of 2.35 years.

Table 1: Descriptive statistics for age of participants

Description	Age Range of CP
Minimum	4
Maximum	12
Mean	7.29
Standard deviation (SD)	2.35

Table 2: Frequency of participants by sex and age

Category	Male	Female	Total
4-6 years	32	18	50
7-9 years	24	18	42
10-12 years	18	9	27

Table 2 breaks down the frequency of participants by sex and age categories. Notably, we observe a balanced representation across the age groups, with a detailed breakdown

of females and males in each category. This distribution sets the foundation for exploring potential correlations or trends within the dataset. The numbers speak to the diversity and scope of our participant pool. With 50 participants falling within the 4 to 6 years age range, 42 within 7 to 9 years, and 27 within 10 to 12 years, our study captures a broad spectrum of developmental stages.

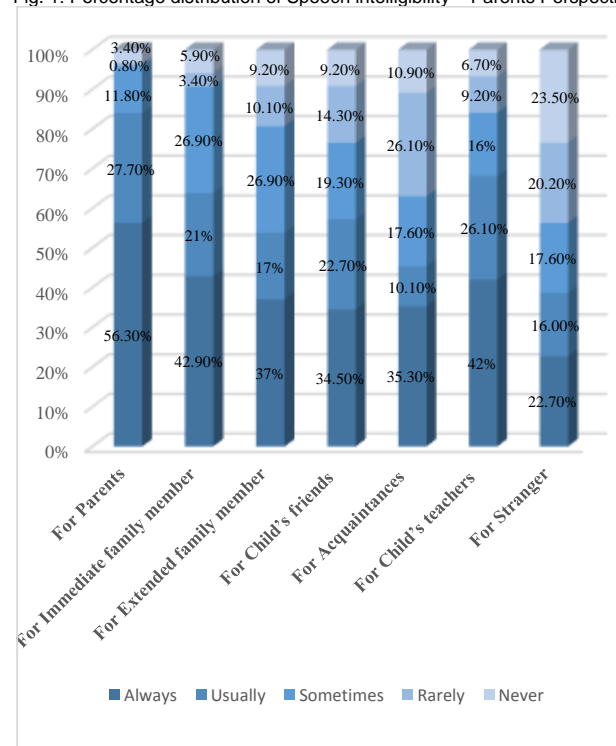
Table 3: Participant scores on the Intelligibility in Context Scale (ICS) (n=131)

Questions	Mean	Standard Deviation
Do you understand your child?	4.32	0.96
Do immediate members of your family understand your child?	3.91	1.17
Do extended members of your family understand your child?	3.62	1.32
Do your child's friends understand your child?	3.58	1.34
Do other acquaintances understand your child?	3.33	1.46
Do your child's teachers understand your child?	3.87	1.25
Do strangers understand your child?	2.94	1.49
Total score (min 7, max 35)	25.62	8.13
Average total score (min 1, max 5)	3.66	1.17

Table 3 presents participant mean scores on the ICS for different communicative partners, including parents, immediate family members, extended family members, friends, acquaintances, teachers, and strangers. The mean scores are presented with standard deviation (SD) values.

The results indicate that, on average, the speech of children with cerebral palsy is highly intelligible to their parents (mean score 4.32±0.96 SD). It is usually intelligible to immediate family members (mean score 3.91±1.17 SD) and teachers (mean score 3.87±1.25 SD). However, for extended family members, friends, and acquaintances, the speech of children with cerebral palsy is sometimes intelligible, with mean scores ranging from 3.58±1.34 SD to 3.62±1.32 SD.

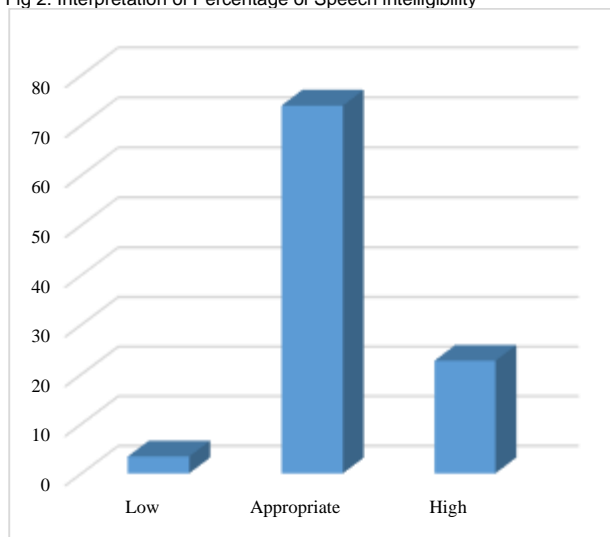
Fig. 1: Percentage distribution of Speech intelligibility – Parents Perspective



The results also show that the speech of children with cerebral palsy is rarely intelligible to strangers (mean score 2.94 ± 1.49 SD). The total mean score of speech intelligibility falls on the ICS is 25.62 ± 8.13 , indicating that, on average, the speech intelligibility of children with cerebral palsy is sometimes (appropriate) intelligible to different communicative partners. Overall, the results suggest that children with cerebral palsy may experience difficulties with speech intelligibility, particularly when communicating with unfamiliar individuals. However, their speech is generally intelligible to those who are familiar with them, such as parents and teachers.

Figure 1 presented in this study depict the percentage of speech intelligibility among children with Cerebral Palsy, as reported by their parents or guardians, across different relationships. In the context of interactions with parents, 56.3% indicated that they always understand their child's speech, while 27.7% reported usually understanding. For immediate family members, 49.9% claimed always understanding, with 26.9% reporting occasional understanding. Extended family members showed a different pattern, with 37% reporting always understanding and 26.9% sometimes. Notably, interactions with friends and acquaintances exhibited distinct patterns, highlighting the nuanced challenges faced by these children. The findings emphasize the need for tailored communication strategies in various social contexts, recognizing the diversity of understanding among parents, family members, friends, acquaintances, teachers, and even strangers when communicating with children with Cerebral Palsy.

Fig 2: Interpretation of Percentage of Speech intelligibility



The results indicate that out of the 119 CP children, 4 (3.4%) have low speech intelligibility. This suggests that these children may experience significant difficulties with speech production and intelligibility. However, the majority of the CP children in the sample (88, or 73.9%) have an appropriate level of speech intelligibility. This means that these children may experience some challenges with speech production and intelligibility, but their speech is generally understood by others. Furthermore, a sizeable proportion of the CP children in the sample (27, or 22.7%) have high speech intelligibility. This suggests that these children may have fewer challenges with speech production and intelligibility, and their speech is easily understood by others.

Overall, these results suggest that while some children with CP may experience difficulties with speech intelligibility, the majority of CP children in this sample have an appropriate level of speech intelligibility, and a significant proportion have high speech intelligibility.

DISCUSSION

The current cross-sectional study was conducted to identify the Speech Intelligibility of children with Cerebral palsy with different communicative partners. The result of this study reveals that children with cerebral palsy speech were found to be most intelligible to their parents and least intelligible to strangers.

Based on the current study, it can be concluded that parents have the highest level of understanding of a child's speech among all the groups surveyed, as indicated by the highest mean score of 4.32 ± 0.95 SD. Immediate family members also have a high level of understanding, followed by extended family members, the child's friend, and acquaintances, with mean scores ranging from 3.91 to 3.33. Child's teachers have a moderate level of understanding, while strangers have the lowest level of understanding, with a mean score of 2.94 ± 1.49 SD.

These findings are consistent with the previous study conducted by Anniek Van Doornik, which also found that parents and immediate family members have a higher level of understanding compared to other groups²⁹. However, the mean scores in the current study are slightly lower than those in the previous study, which may be due to differences in the sample size, methodology, and population characteristics. Comparing the results of the current study to the previous study, it seems that the mean scores reported for each group are generally consistent between the two studies, with some variations. For example, in the current study, the mean score for acquaintances is lower than that reported in the previous study, while the mean score for strangers is lower in the current study. However, overall, the findings from both studies suggest that parents and immediate family members tend to perceive a child's speech as more intelligible than acquaintances, friends, and strangers.

The present study reveals that parents have the highest level of understanding of their child's speech, while strangers have the lowest level of understanding. This suggests that individuals who have a close relationship with the child are more likely to understand their speech. The total mean score for speech intelligibility using the ICS is 25.62 ± 8.13 SD and the average mean score is 3.66 ± 1.17 SD. These findings suggest that, on average, the child's speech is sometimes intelligible to their communication partners. A similar study conducted by Stefanie j g Veenhuis in 2021 on Dysarthria in children and adults with ataxia telangiectasia found that the total ICS score for all participants was 3.88, with children having a total ICS score of 3.83³⁰. This indicates that, on average, the participants in the study were sometimes to usually understandable. The total ICS score for adults in the study was 4, indicating that they were usually understood.

Overall, these findings suggest that speech intelligibility is affected by various factors, including the communication partner and the underlying speech disorder. They highlight the importance of considering multiple perspectives when assessing speech intelligibility and the need for tailored interventions to improve speech intelligibility in children and adults with speech disorders.

The present study on 119 children with CP shows that 73.9% of children have appropriate speech intelligibility, while 22.7% of children have high speech intelligibility score of 5.00 on ICS taken as high intelligibility, and only 3.4% children have low intelligibility of speech that falls in the ranging score of 1.00 showing low intelligibility. These findings are similar to a previous study conducted by McLeod in 2012, which also used the ICS to indicate a child's level of functional intelligibility. The ICS scores range from 1.00 (low intelligibility) to 5.00 (high intelligibility), and an average score of 3.5 may indicate that the child is usually to sometimes understood²⁸.

These findings suggest that the majority of children with CP in the study population have appropriate speech intelligibility, with a smaller proportion having high or low levels of intelligibility.

CONCLUSION

Speech intelligibility is a key aspect of children's participation in daily life. The current study highlights the importance of considering the listener's familiarity with a child's speech when evaluating speech intelligibility. The findings suggest that parents perceive their children as being more understandable to those with whom they have close relationships due to their greater familiarity with their child's speech. This emphasizes the importance of taking into account the child's relationships with their communication partners when assessing their communicative participation.

The study also found that children were judged as being more intelligible to parents than immediate family and extended family, and less understandable to strangers. This highlights the impact of familiarity and relationships on speech intelligibility and emphasizes the need for tailored interventions to support communication development in children with different communication partners.

Overall, the findings suggest that speech intelligibility is a joint effort between the speaker and the listener, and both factors should be considered in assessing and supporting children's communicative participation.

Authorship and contribution declaration: Each author of this article fulfilled following Criteria of Authorship:

1. Conception and design of or acquisition of data or analysis and interpretation of data.
2. Drafting the manuscript or revising it critically for important intellectual content.
3. Final approval of the version for publication.

All authors agree to be responsible for all aspects of their research work.

Conflict of interest: None

Funding: None

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This article may be cited as: Khan M, Firdous A, Rehman AU, Hameed S, Zulqarnain Z, Farid G: Parent's Perspective about Intelligibility of Speech in Children with Cerebral Palsy *Pak J Med Health Sci*, 2023;17(10): 32-35.