AL-AASAR Journal
Quarterly Research Journal
www. al-aasar.com
Vol. 2, No. 2 (2025)
Online ISSN: 3006-693X
Print ISSN: 3006-6921

APPLICATION OF AUGMENTATIVE AND ALTERNATIVE COMMUNICATION IN SPEECH THERAPY: A CASE STUDY OF DYSARTHRIA PATIENTS IN KARACHI

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Abstract
The qualitative case study focuses on application of augmentative and alternative communication (AAC) systems, which are inspired by the speech-generating device utilized by Stephen Hawking, in language therapy with adult Dysarthria patients at Dow Hospital, Karachi. The researchers observed 8 therapy sessions of Dysarthria patients (8 patients) and conducted semi-structured interviewed 4 language therapists and 8 patients. The participants were choosen via purposive sampling. The study followed the five-stage critical qualitative research developed by Carspecken (1996). The findings of the study demonstrate that AAC devices made a tremendous positive change in intelligibility and communicative participation: Dysarthric messages augmented with speech-synthesized output were almost always comprehended without repetition, when unassisted speech was frequently unintelligible. Among the main advantages, there was increased clarity, confidence of the listeners, and empowerment of patients. Nonetheless, there was a steep learning curve, need of extensive training, technical and language barriers (e.g. lack of Urdu voice output) and initial resistance on belief of natural speech. This paper supports the life-changing AAC potential in terms of Dysarthria and noted the practical considerations that influence the adoption of the technology.

Keywords: Speech therapy, Dysarthria, Karachi, Qualitative, Augmentative and Alternative communication, Stephen Hawking

1 INTRODUCTION
Dysarthria is a motor speech disorder, which makes the speech of a person weak or slurred, and the intelligibility of speech is greatly reduced (MacKenzie, 2018). Dysarthria often results after a stroke, in Parkinson disease, Amyotrophic Lateral Sclerosis ALS, or traumatic brain injury, and such patients often have trouble communicating effectively in real life (Spencer & Brown, 2018). Conventional speech therapies (e.g., breathing exercises, articulation drills) are aimed at strengthening the speech mechanism, yet they bring minor improvements in most cases, particularly with moderate and severe cases (Mackenzie & Lowit, 2012). Augmentative and Alternative Communication (AAC) systems, which include low tech picture boards and high tech speech generating devices (SGDs) are compensatory in nature as they supplement or replace natural speech (Beukelman & Mirenda, 2013). It has been shown that AAC does not inhibit speech attempts, but it may facilitate residual vocalization (Millar, Light, & Schlosser, 2006). The most famous example of an ALS patient who used SGD and inspired generations of users with his example is Stephen Hawking, who used an eye tracking device and text to speech software during decades, showing what advanced AAC can do even in the case of a completely paralyzed person (Donaldson et al., 2021). His example demonstrates the potential of predictive text technologies and personalized voice output to empower users who keep on communicating complex thoughts even when they have been severely motor-impaired.

Khan et al. (2020) conducted a survey among 46 speech language pathologists in six major cities of Pakistan and found out that only 50% of them were aware of AAC devices, and used them in practice. Another study found a slightly higher awareness rate of about 51%, with limited applications in therapy sessions, which highlights a serious gap in training and policy

regarding the use of AAC (Hussain et al., 2019). This study thus investigates the applications of AAC at Dow hospital, Karachi. The multilingual context in Karachi adds some more factors: patients can use Urdu, Sindhi, Punjabi, Pashto, or English, and the compatibility of the language is a significant factor affecting the usability of AAC. Providing the framework of Language Choices Policy (LCP) model (Spolsky 2004; further developed by King 2008) the paper discusses the relationship between ideology (beliefs about language), practice (actual language use, including AAC modes) and management (institutional and policy support) and can be seen as a rich interpretative lens through which changes in communication behavior and beliefs can be explored. The following objectives are set to be reached in the study:

1. To examine the application of AAC systems, inspired by Stephen Hawking in improving the speech clarity and communication efficiency amomg Dysarthria patients at Dow hospital Karachi.
2. To explore the user experiences of AAC technology among Dysarthria patients.
3. To understand the benefits and challenges associated with the use of ACC among Dysarthria patients

2 LITERATURE REVIEW

The degraded articulation, phonation, and prosody resonance is observed in Dysarthric speakers: it results in a decrease in speech intelligibility (MacKenzie, 2018). Speech is one of the functions of behavioral interventions that may give good individual results. Indicatively, Mackenzie and Lowit (2012) present that a number of patients with stroke related Dysarthia have been found to have improved intelligibility after receiving a customized therapy, though not all the participants improved in the same measure. It is suggested that automated speech analysis can be used to measure and monitor intelligibility (Troger et al., 2024; Bayestehtashk et al., 2015). Beukelman and Mirenda (2013) supported the use of AAC as one of the major compensatory methods in the situation when speech is unintelligible. According to the results, the intelligibility can be improved greatly with the AAC supplementation, e.g., first letter boards (Hanson et al., 2010; Beukelman, Yorkston, & Milenkovic, 2004). In Dysarthria therapy, Hanso et al. (2010) demonstrated that alphabet supplementation lowered the number of misunderstandings because it helped to direct the expectations of the listener in a conversation (Hanso et al., 2010). The most technologically advanced AAC devices with predictive text and digitized speech provide fast and efficient communication (Donaldson et al., 2021). SGDs are capable of delivering voice outputs at a level of clarity that is consistent, and this lowers the effort required by the listener, and also improves the flow of conversation (Light & McNaughton, 2012).In addition to intelligibility, AAC encourages confidence and social interactions. The users tend to report lesser anxiety and more engagement in (Ball, Fager & Fried Oken, 2012). Particularly, this applies to collectivist societies where communication within the family takes centre stage (Mirza & Tareen, 2019). The most frequent barriers are therapist training, language assistance, and expense: even in high-income contexts. (Baxter et al., 2012; Broomfield et al., 2021). The AAC tools lack multilingual feature, which support local languages, and thus not very practical. The absence of institutional policies additionally damages adoption, although therapists can create workarounds (e.g., low-tech aids, improvised translation) to fill in access gaps (Hussain et al., 2019; Khan et al., 2020). The LCP model described by Spolsky points to the influence of beliefs, practices and policies in making language choices such as deciding to speak or use assisted communication. King (2008) has shown the effect of attitudes towards language on

Vol. 2, No. 2 (2025)
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the acceptance of bilingual or multimodal mode in education, many of the parallels of which can be found in the AAC therapy environment.

3 STUDY DESIGN AND FRAMEWORK

The present study is the critical qualitative research methodology based on the five-stage approach developed by Carspecken (1996). The researcher used nonparticipant observations (Stage 1), analytic reflection (Stage 2), interactive interviews to understand users' perspectives (Stage 3), and lastly contextual system analysis (Stages 45) to connect the findings to larger healthcare and policy concerns. Overall, LCP framework was used to organize data: beliefs and attitudes (ideology), the actual language/AAC use during sessions (practices), and factors related to institution/society (management) were noted as influencing therapy.

3.1 Site and Participants

The research was conducted in the speech-language clinic of Dow University Hospital, Karachi, Sindh. Purposive sampling was used technique to identify participants who could probably provide insight into our research questions. The participants were 4 speech-language pathologists (SLPs). Each of them had a minimum of 2 years experience in treating Dysarthria patients and 8 Dysarthria patients.

3.2 Data Collection

The researcher observed a total of 8 language therapy sessions. During these sessions, patients tried to talk and use AAC to do it. To record verbal interactions, gestures, using devices, and successful or failed communication, the researchers maintained the field-notes. Observations were followed by semi-structured interviews with every patients and therapists. The used AAC system was based on Stephen Hawking inspired speech-generating device with eye-gaze or pointer access and word prediction. Letters or entire words on a digitized board were chosen by the patients; the machine thereafter synthesized the sentence using a computerized voice. Urdu text-to-speech was employed where available and an English option was also provided. The patients were trained by their therapists in simple navigation: e.g. pointing to letters, utilisation of prediction rows and verification of the output of the device. Sessions entailed a combination of conventional speech drills and AAC practice.

3.3 Data Analysis

The data analyses process involved several stages: In the first stage, the researcher kept descriptive field-notes of what was observed (who said what, context, body language). In the second stage, researchers read notes and transcripts and wrote memos about occurring patterns (e.g., situations when AAC definitely facilitated or confounded communication). To construct an emic perspective, mutual understandings in interviews, where participants were requested to clarify their communication decisions was carried out in the third stage. In this last stage, the researchers related themes to larger frameworks: decision-making practices of therapists, cultural beliefs regarding technology and policy limitations. At the same time, the data was coded as per LCP components. This triangulation warranted a rich interpretation of data. The study was ethically approved by DUHS and all the participants provided informed consent.

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4 FINDINGS AND DISCUSSION

The findings of the study present that AAC has the potential to transform the communication experience of Dysarthia patients. The observations revealed a sharp contrast; the sessions with AAC and without it were qualitatively different: listeners were attentive, confusion disappeared, and patients seemed relaxed. Interviews established that both patients and therapists believed that these improvements were as a result of the application of AAC. This analysis put the results in a wider perspective: it was observed that the success of communication was determined not only by technology, but by its harmonisation with the linguistic background of participants, as well as by the transcendence of sociocultural barriers. The following were main themes emerged out of the data.

4.1 Enhancement of Speech Clarity through AAC Systems

The observation data and interviews with therapists showed that AAC tools were very effective in enhancing the intelligibility of speech among dysarthia patients, especially moderate and severe cases. After 5 7 sessions of AAC-integrated therapy, an improvement could be measured in most patients. Some of the devices were speech-generating devices (SGDs), eye-tracking, and mobile AAC apps that allowed customizable voice banks. According to therapists, patients could express their needs and could involve themselves in brief conversations more effectively at the end of the observation period. The results are consistent with the other related studies, which suggest that AAC systems improve the intelligibility and smoothness of the speech of people with motor speech disorders (Beukelman & Mirenda, 2017). The legendary use of an SGD by Stephen Hawking created a precedent that technology can relevantly replace or complement damaged speech. Their inclusion in Dow Hospital is an indication of an increased realization of the usefulness of these tools in South Asia. But, this was not the case with the West where the access to technology is more common; at Dow, it had to be adopted and familiarized first (Koul, Corwin, & Hayes, 2005). The increase in clarity can be viewed in terms of the LCP framework: using AAC was a change in language practice and language management as therapists were keen to guide patients into using the technological speech aids. Language ideology was also involved, since the acceptance of “non-oral” communication as a legitimate speech grew over time in both caregivers and patients.

4.2 Communication Participation and Social Confidence

Patients with AAC tools were more inclined to take part in group discussions and participation in therapy. Some of the non-working patients reported a new desire to reunite with social groups, family conversations, or even start working. One of the female participants said: I feel like I can hear again. Occupational and speech therapists observed the following changes in patients who used AAC regularly: better eye contact and emotional expression, lesser anxiety. These outcomes advocate studies that focus on the psychosocial advantage of AAC systems. Light and McNaughton (2012) are of the opinion that communication is beyond linguistic- it is highly social and emotional. AAC devices, with their capacity to express, decrease isolation and foster inclusion. It becomes especially important in South Asian cultures, where family and community involvement are essential well-being constituents (Mirza & Tareen, 2019). Such transformation is a change in the subjective epistemology -patients started regarding themselves as capable communicators. The patients who previously opposed the use of AAC tools, eventually re-conceptualized speech as a form of communication and not vocalization.

4.3 Technological Learning Curve and Usability Challenges

Although AAC systems enhanced communication, patients and therapists suggested higher learning ratio. The elderly patients (50-60 years old) were particularly not adept at using equipment such as tablets or eye-tracking programs. The positive results could only be attainted after therapists spent a lot of time training patients on navigation of AAC. Physical contact with devices was challenging to some of the patients with hemiparesis. Other users complained about the delays in response or Urdu-language AAC bugs. The issue of usability is well reported in the AAC literature. As Dumitru (2025) point out, although AAC systems are effective, they are usually designed with a certain degree of digital literacy that is not shared by all users. This could be seen in the setting of Dow Hospital, whereby patients with diverse socioeconomic and educational statuses were exposed to unfamiliar technologies. The theme is a good representation of the language management component of LCP: therapists were the language managers who needed to enact measures that would overcome technological differences. A critical approach by Carspecken makes us think about power and access- technology empowered some people, and temporarily disabled others. The research corroborates other results obtained by Fager et al. (2011) that state that adaptability and user-centered design is key to the success of AAC interventions.

4.4 Cultural and Linguistic Alignment of AAC Content

Culturally and linguistically, participants and therapists reported the shortcomings of AAC systems. Emotional intonation and natural phrasing was not present in Urdu and Sindhi AAC voice banks. Computerized voice was considered as foreign or robotic by some patients. Also, culturally specific words, like a traditional greeting or an idiom, were usually absent in pre-programmed choices. Therapists were often required to enter context specific expressions manually. This observation concurs with those of Ball, Fager, and Fried-Oken (2012), who assert that user acceptance of AAC tools requires cultural congruency. Temporarily alienating some of the patients was caused by the discrepancy between the language content of AAC and the local linguistic conventions. Indicatively, one of the participants was reluctant to use certain expression through an AAC device since it was mechanical and not contextualized. LCP framework highlights the following dynamics in language ideology and practice: when patients regard a way of communication as not natural or not fitting the culture, they will not be able to use it effectively. Even when the policy is implicit as noted by Spolsky (2004), it is influenced by ideologies concerning what should be acceptable or rather what should be regarded as real language. This issue promotes the idea of the localized development of AAC, including linguistic corpora of local dialects and emotional expressions.

4.5 Institutional Support and Therapist Adaptability

Mixed reactions were recorded with regard to institutional support among therapists at Dow Hospital. Some of the AAC tools were either purchased with research grants or donated, but regular access to advanced technologies was still restricted. Therapists mentioned a lack of training on AAC developments and no maintenance of devices. Still, therapists were flexible, and developed low-tech AAC solutions (e.g., picture boards, gesture-based charts) when their patients had low access. This supports the findings of Baxter et al. (2012) who opine that the key to the success of AAC lies in institutional infrastructure and training. The finest devices may not be fully utilized or used correctly without administrative dedication. It implies the language management aspect of LCP- therapists as policy agents took strategic steps in implementing AAC despite the systemic constraints. A critical perspective developed by Carspecken (1996) focuses on system relations or the influence of macro-structures (policy, funding, institutional culture) on micro-level language experiences. The Dow Hospital

therapist flexibility is a promising variable; however, the long-term change requires an institutional investment in AAC resource training and repair.

5 Conclusion

Implementation of a Hawking inspired AAC system into the language therapy of the Dow Hospital resulted in significant changes in communication of the Dysarthria patients. Patients started to communicate in an understandable way and they became more involved in the process. Therapists considered AAC to be superior to purely restorative exercises in functional outcome many times. The most relevant advantages were clarity, confidence, and autonomy, whereas the most relevant disadvantages were training, technical /language mismatch, and resource limitations. The implementation of AAC such as the one used by Hawking can transform the lives of Dysarthria patients, yet it cannot be successful without investing in training and cultural adjustment. To maintain these improvements, this paper suggests that Dow Hospital (and other centers) should establish formal AAC programs, with multilingual support and therapist training, to maintain these improvements. The example of Stephen Hawking himself, the technology-enhanced voice, even the synthesized one, can be a powerful means to restore the lost communication to the people who lost it. This study is not a randomized trial but well planned inquiry. The sample was suitable to achieve thematic saturation by qualitative standards. However, the results are particularly limited due to the resources of urban Karachi. Nevertheless, they are widely in line with the international AAC research, indicating broader applicability. Furthermore, it is recommended to examine the AAC use among diverse population in future studies.

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