v. 4, n. 99, 2024

International Journal of Health Science

ALTERNATIVE AUGMENTATIVE COMMUNICATION FOR CHILDREN WITH AUTISM SPECTRUM DISORDER: A SCOPING REVIEW

Acceptance date: 18/11/2024

Ghirlanny da Costa Albuquerque
http://lattes.cnpq.br/5752584306852903

Emanuela Machado Silva Saraiva
http://lattes.cnpq.br/9143395514950680

Leila Verônica da Costa Albuquerque
http://lattes.cnpq.br/2650759319500888

Fernanda Vieira Soares
http://lattes.cnpq.br/8423600432354004

Braulio Costa Teixeira
http://lattes.cnpq.br/2896641561559199

Vanusa Maria Gomes Napoleão Silva
http://lattes.cnpq.br/7119313172540097

Edna Maria Camelo Chaves
https://lattes.cnpq.br/1859568119130292

Abstract: To map the scientific evidence in the literature on the effectiveness and applicability of alternative augmentative communication (AAC) in children with Autism Spectrum Disorder. A five-stage scoping review was carried out based on the JBI manual and the guide to improving the review protocol. The following databases and repositories were consulted: *Medical Literature Analysis and Retrieval System Online* (MEDLINE) via PubMed, Latin American and Caribbean Health Sciences Literature (LILACS), Web of Science, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Cochrane Library and Embase. The inclusion criteria were articles that presented the effectiveness of applying high or low-tech CAM to children with autism, including randomized clinical trials or quasi-experimental trials, with no time or language limits. The exclusion criteria were studies in the design phase or without conclusive results. The search results were exported to the *Rayyan* reference manager. The *Preferred Reporting Items for Systematic Review and Meta Analyses* flowchart was used for selection. We selected six international articles, which showed that the use of low and high technology contributes to language and behavior. There is a predominance of foreign articles on the subject, which are relevant and guide professional intervention with autistic children with complex communication needs, enabling the acquisition of speech and functional language.
Keywords: Autism Spectrum Disorder, Augmentative and Alternative Communication Systems; Child; Assistive Technology.

INTRODUCTION

Autism Spectrum Disorder (ASD) is characterized by persistent deficits in communication and social interaction in multiple contexts, including in social reciprocity, in non-verbal communication behaviours used for social interaction and in abilities to develop, maintain and understand relationships.[1]

The *Centers for Disease Control and Prevention* (CDC) in the United States, in 2023, updated the prevalence of autism, in which 1 in 36 children aged 8 are autistic[2]. In Brazil, there is still no evidence of the prevalence of autism, so based on the data from research carried out in the United States, there could be an estimate of 295,000 autistic people out of 213 million Brazilians, according to the Autism Channel.

Reflecting on this number, among the alterations found in autism, the difficulty in communication is evident, as there are non-verbal autistic people and verbal autistic people who need other means to express themselves, this is augmentative/alternative communication aimed at people with complex communication needs.[3]

One of the indications for developing functional communication in autism is the implementation of Alternative Augmentative Communication (AAC), which, according to the *American Speech- Language Hearing Association* (ASHA), represents an area of clinical practice that aims to complement or compensate for deficiencies in expression and comprehension, including spoken or written modes of communication.[4]

Thus, about a third of children affected by ASD are considered non-verbal or show minimal verbalization[5]. Therefore, individuals with ASD need an alternative communicative resource that enables them to initiate, sustain and expand the dialogical context and that can also take into account the inabilities of shared attention, eye contact and difficulty in communicative intentionality.[6]

Assistive technology[7] is defined as support, equipment, services, strategies and practices applied to reduce the difficulties of people with disabilities. Assistive technology can be divided into 11 categories[8] : 1. Daily living aids, 2. Augmentative and alternative communication, 3. Computer accessibility resources, 4. Environmental control systems, 5. Architectural designs for accessibility, 6. Orthotics and prosthetics, 7. Postural adaptation, 8. Mobility aids, 9. Aids for the blind or partially sighted, 10. Aids for the deaf or hard of hearing and 11. Vehicle adaptations. For people with complex communication needs diagnosed with ASD, category 2 assistive technologies are designed to address an important characteristic of autism, which is the difficulty in communicating[9] through AAC. As such, there are various communication systems with a wide repertoire of representative elements, such as photographs, drawings and pictograms[10].

The supports for these systems can be both low-tech (concrete material) and high-tech (computer systems). Low-tech includes the communication folder made up of cards with photos or drawings, and high-tech refers to applications, programs, digitized or synthesized voice.[11]

The implementation of alternative augmentative communication for autistic people can be applied from early childhood through second childhood to adulthood. AAC can be used as a therapeutic tool that aims to promote functional communication, developing the individual's communication skills such as vocabulary acquisition, organization of thought, understanding of the world, encouraging the expression of feelings, requests, wishes and learning.[12]

However, there is a lack of scientific evidence on the effectiveness and applicability of augmentative and alternative communication in non-verbal or minimally verbal autistic children. This provides food for thought regarding the development of relevant scientific research aimed at the effectiveness and intervention of augmentative and alternative communication in autism.[13]

This led to the following question: what is the evidence on alternative augmentative communication for functional language development in children diagnosed with Autism Spectrum Disorder? Therefore, the aim is to map the scientific evidence in the literature on the effectiveness and applicability of alternative augmentative communication in children with autism spectrum disorder.

METHOD

This is a five-step scoping review based on the JBI manual and the review protocol improvement guide. The protocol record for the scoping review is DOI 10.17605/OSF.IO/AFC8Q. The protocol for this review was published in *Research, Society and Development, DOI:* http://dx.doi.org/10.33448/rsd-v11i12.340851.

The inclusion criteria were: articles on the effectiveness of applying augmentative alternative communication to children with autism and using alternative communication apps (high-tech) or communication folders (low-tech), including randomized clinical trials or quasi-experimental trials, with no time or language limits. Studies in the design phase or without conclusive results were excluded.

To develop the search strategy, the mnemonic "PC" was used, where P represents the population studied (children with Autism Spectrum Disorder) and C the concept (alternative communication), in order to develop the descriptors and the search equation, as described in Chart 1.

The searches were carried out on 07/01/2023, using Health Sciences Descriptors (DeCs) and *Medical Subject Headings* (MeSH). The following databases and repositories

	P	C
Extraction	Children with Autism Spectrum Disorder	Alternative Communication
Conversion	Childhood autism	alternative and augmentative communication systems
Combination	autistic child; Child with autism; Childhood Autism	Augmentative and Alternative Communication Alternative and Expanded Communication Alternative and Supplementary Communication
Construction	"autistic child" OR "Child with autism" OR "Childhood Autism	"Augmentative and Alternative Communication" OR "Alternative and Expanded Communication" OR "Alternative and Supplementary Communication"
Use	"autistic child"OR "Child with autism" OR "Childhood Autism" AND "Augmentative and Alternative Communication"OR "Alternative and Expanded Communication" OR "Alternative and Supplementary Communication" AND World OR Global OR Planet	

Chart 1 - PC strategy for health information retrieval. Ceará, 2022[14]

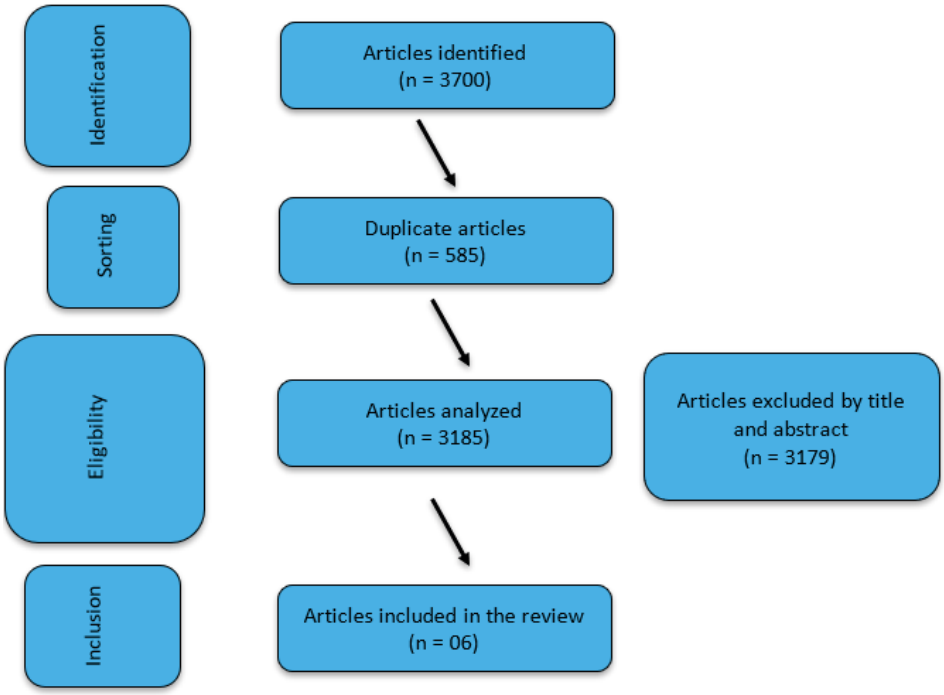

Figure 1 - Flowchart of article identification, scanning and inclusion process[17]

were consulted: *Medical Literature Analysis and Retrieval System Online* (MEDLINE) via PubMed, Latin American and Caribbean Health Sciences Literature (LILACS), *Web of Science, Cumulative Index to Nursing and Allied Health Literature* (CINAHL), Cochrane *Library* and *Embase*. Gray literature was retrieved from the following sources: *Google Scholar*, Brazilian Digital Library of Theses and Dissertations (BDTD) and reference sites such as: www.isaacbrasil.org.br, https://assistiva.com.br/ca.html, https://www.asha.org, https://www.acessibilidade.gov.pt.

The search results were exported to the *Rayyan* reference manager*, developed by the Qatar *Computing Research Institute* (QCRI). Duplicate articles were removed, followed by exclusions from the manager's own filters. This process was carried out independently by two researchers, and any discrepancies were resolved jointly. The first stage was selection by reading the title and abstract. Afterwards, the full text was read and analyzed to ensure that the study remained in force. Finally, manual searches were carried out on the references of the included studies. The *Preferred Reporting*

Items for Systematic Review and Meta Analyses flowchart was used for selection.[15]

The data was presented descriptively using tables and charts. A data extraction form was used based on the model proposed by the JBI, with the following variables: year, author, title, country of study, language, objective, method and result.

For the synthesis, Bardin's Content Analysis technique was used, following the stages: completeness, representativeness, homogeneity and pertinence, with categorization and grouping of the contents identified.[16]

RESULTS

This scoping review included 06 (six) studies, of which 05 (five) were of English origin and 01 (one) of Spanish origin. The methods used included randomized clinical trials and quasi-experimental trials. The detailed selection of trials is described in figure 1.

The articles selected show that AAC benefits autistic people through low-tech with the use of PECS (*Picture Exchange Communication* System) and high-tech (*tablets* with apps, devices with voice output).

The AAC contributes to early intervention for language development in the treatment of autistic children, as the use of visual clues can favor vocabulary acquisition. In addition, low-functioning autistic children make gains in language acquisition when augmentative/alternative communication is introduced into their daily lives. AAC stimulates communication, encourages requests and improves behavior[21].

For the AAC to be effective, it is necessary for the family and the school to work together, since the importance of these two institutions in encouraging the use of the AAC by people with autism is recognized.[3,20]

Even though these are international studies that reflect the reality of other cultures, there is an important need to reflect on the situation of AAC in Brazil, from the way this technology has been introduced to the training of professionals in its use and guidance for families and schools in this process.

DISCUSSION

Studies show that 20 to 30% of children with ASD will never develop speech and therefore need communication support to help them through all their life processes.[18]

Gradually, augmentative alternative communication (AAC) has been expanding its applicability as a way of developing language in autism spectrum disorders. Families, professionals and schools are discussing access, usability, benefits and results of AAC. Six articles were selected to compose the discussion referring to the use of low-tech or high-tech AAC in autism.

Based on this study, there is a reflection on the importance of using the AAC, as a possibility for functional communication and making the individual the protagonist in the communication process. While parents and teachers reported high operational competence and adherence to the use of the AAC, this use is less frequent during the working days of the week. [19]

In order to optimize the autistic child's communication development, it is necessary for the family to be present and to enable communication situations with the child so that he or she can have initiative, autonomy and obtain the meaning of language. Systematic training is effective for parents to learn behaviours associated with the language development of their children with ASD, including: the number of opportunities for parent-child interaction, greater response to the child's communicative attempts, the quantity and quality of stimulation offered by the family, the use of learning strategies and language development that provide well-being and socialization for the child.[20]

The establishment of functional communication has a direct impact on general development and quality of life, enabling autonomy, freedom of choice and expression[21]. It can favor quality education, contributing to cognitive development, inclusion in the school environment and improvements in family relationships. AAC can be used as a therapeutic method that aims to promote functional communication, thus developing the individual's communication skills. This can take place using low-tech or high-tech resources, such as *tablets*, communication boards and picture exchange.

Speech therapists are responsible for conducting interventions that stimulate multimodal communication, whether through gestures, vocalizations, words, communication boards or apps, as well as sensitizing families and caregivers to optimize communication methods as a way of integrating the autistic person into the environment. Early intervention can favor parental training and communication development.

The study by Fortea-Sevilha[22] and others found that the level of early intervention and the inclusion of the AAC associated with cognitive level contributed to the progress of autistic children. This is in line with Braga[23], as early stimulation favors greater chances of promoting neuroplasticity, enabling quality of life, and the inclusion of the AAC promotes development and learning. It is estimated that 40%-90% of people with ASD have Sensory Integration Dysfunction and predominantly learn through visual connections, so the PECS (*Picutre Exchange Communication System*) can be used to stimulate learning and communication.[24]

We understand that early intervention and family participation enhance the child's development. And when we take into account the condition of autistic children, because they learn effectively through visual means, we must consider methods and strategies that enable communication. We can consider that augmentative and alternative communication, which includes low-tech and high-tech, will be used to provide learning. This is confirmed in the study by Gilroy, Leader and Maclear[25] which shows that high technology promotes good results in AAC, corroborating Schimmer[26], who mentions that high technology for AAC in people with ASD is effective and appropriate for developing communication and interaction skills.

Despite the significant number of AAC apps on the market and informational videos available on internet platforms and training on the use of AAC, aimed at parents and professionals in the field, they are still restricted[27]. Speech and hearing therapists need to take ownership of the practice and disseminate it throughout the public and private sectors, and fight for public policies to include AAC, both in society and in other sectors, and make it accessible to people with complex communication needs and their families.

Technologies help the cognitive development of children with ASD and are used by a significant number of professionals who aim to turn difficult and complex communication into pleasurable and stimulating communication[28]. We must take into account that autistic people prefer visual resources, as sight is the most favored sense in children with autism[24].

It is important to note that research comparing high, medium and low-tech augmentative alternative communication systems has found no significant differences in effectiveness when compared to the different systems. [29]

The professional's assessment of the application of the AAC with the autistic person will make it possible to choose the communicative medium in which the patient will have the best response. It is up to the speech therapist to have the knowledge and

Article	Title	Authors	Language	Country	Year	Objectives	Results
A1	The relationship between operational competence, adherence and use of augmentative and alternative communication in school-aged children with autism	Jenna de Carlo Allison Feijão, Samanta Lyle Linsey Paden Miller Cargil l	English		2018	was to investigate the relationship between two variables that influence the use of augmentative and alternative communication (AAC), the caregiver's operational competence (i.e. the ability to navigate, customize and program the device) and adherence to the AAC system	Only 10 students used the CAA on weekends. Despite the high rates of operational competence reported by parents and teachers. The participants did not use it to any great extent.
A2	Early language development in young children with autism spectrum disorder through the use of alternative systems	M. Sol Fortea-Sevilla, M. Olga Escandell-Bermúdez, José Juan Castro--Sánchez, Juan Martos-Pérez	Spanish	Spain	2015	To demonstrate the effectiveness of SAAC in the development of oral language in non-verbal young children diagnosed with ASD.	They show improvements in all children, but to different degrees. We need to analyze the reasons for these differences. The children developed their oral language to a certain extent within a year. Early attention and the use of SAAC with visual supports favor the development of oral language in children with ASD in the first years of life. Early intervention and the use of CAA with visual supports favor the development of oral language in children with ASD in the first years of life. We think that this is a variable that can influence the cognitive development of each child.
A3	A Pilot Community--Based Randomized Comparison of Speech Generating Devices and the Picture Exchange Communication System for Children Diagnosed with Autism Spectrum Disorder	Shawn P. Gilroy, Geraldine Leader, Joseph P. McCleery	English	USA	2018	compare the effects of the Picture Exchange Communication System (PECS) for a teaching sequence using a high-tech Speech Generating Device (SGD) to teach social networking communication behaviors	AAC approaches resulted in significant improvements in communication and that these improvements did not differ significantly between the two approaches. support the use of high-tech AACs and highlight the need for evidence-based guidelines for their use. that both "high-tech" and "low-tech" interventions were effective in improving behavior and that there was no significant difference between the two approaches
A4	Augmentative and Alternative Communication for Children with Autism Spectrum Disorder: A Randomized Study of Awareness and Developmental Language Interventions	G ÖZYURT, Ç DINSEVER ELiKÜçÜK	English	USA	2020	to evaluate the effectiveness of augmentative and alternative communication systems for autistic symptoms; language characteristics and emotional regulation of children diagnosed with autism spectrum disorders (ASD).	communication systems that use computer-based voice output communication aids, which are portable and simple, can help children develop communication and language skills.

A5	The effectiveness of the Picture Exchange Communication System (PECS) for children with autism spectrum disorder (ASD): A South African pilot stud	Julia Travis and Martha Geiger	English	England	2010	investigate the effects of introducing the Image Exchange Communication System (PECS) on the frequency of requests and comments and the duration of verbal utterances of two children with autism spectrum disorder (ASD) who had some spoken language, but limited use of language in communicative exchanges.	participants benefited from the introduction of PECS. highly effective treatment for requests and mixed results for comments and verbal duration statements. There were considerable increases in intentional communicative acts (ICAs) for both participants, with marked increases in request (function) and in the development of forms of communication (from augmented speech with images to speech-only utterances)
A6	The Impact of IQ on using high -tech Augmentative Alternative Communication AAC in children with Autism Spectrum Disorder ASD	Rana Zeinaa, Laila AL-Ayadhi, Shahid Bashir	English	King Saud University	2015	Examining the role of IQ in the use of augmentative and alternative communication (AAC) that runs on an iPod touch to improve the spontaneous communication of children with low-functioning ASD in their daily communication needs.	The present study examined the role of IQ in the use of augmentative and alternative communication (AAC) that runs on an iPod touch to improve the spontaneous communication of children with low-functioning ASD in their daily communication needs. Results: The results indicated no significant difference between the three groups.They obtained the same benefits from high-tech AAC. TEA with lower functional could benefit from high-tech CSA to the same extent as high-functioning children

Table 2 - Selected articles

analyze the level of response, as well as to include the family in this process of training and acquiring the communicative resource.

Thus, the choice of system is efficient when it meets the needs of that individual, respecting their needs and choices, emphasizing that there is no system that is better or superior to another.[30]

It is necessary to consider that the communication system with voice output can stimulate language in autism[31]. In Young's research[32], the advantage of using a speech-generating device is associated with the production of voice output, which means that messages can be better understood even if the interlocutor has no training in its use, promoting greater socialization in the social environments of its users. These devices favor the acquisition of speech and language, encouraging communication.

According to Travis and Geiger[33], the PECS (*Picture Exchange Communication System*) provides an expansion of vocabulary and a broadening of communicative intent; this study is in agreement with Silva, Coelho and Farias[34] who show that the use of PECS in the treatment of children with ASD optimizes verbal communication in those with speech difficulties, as an individual strategy, through the use of picture exchanges carried out independently, followed by vocalizations or approximations of words with communicative intent, reaching functional speech in some cases. In addition, the use of PECS can enhance verbal comprehension as it adds visual clues to auditory-verbal information and, in some cases, promotes increased verbalization.[35]

High-tech AAC benefits low-functioning autistic people, according to Zeina, Ayadhi and Bashir[36], because mobile apps are functional resources that can aid learning by providing important new visual and sensory experiences for children with ASD[37].

International studies indicate favorable results for the use of high technology, including tablets and smartphones as an AAC tool[38, 39, 40], the use of devices in Brazilian research is lower, with the prevalence of low-tech communication, methods based on the exchange of figures such as PECS and PECS-adapted[41].

The use of low-tech AAC resources proved to be more productive for the mothers taking part in the study than electronic resources such as *tablets*[42]. According to the study, high technology poses new demands and challenges, including learning to configure the device, handling it with the child in interaction and dealing with frustrations during the training phase with the technology.

When analyzing ASD in autism, for Levi Vygotski, the acquisition of knowledge is achieved through mediation between the human being and the environment[43]. Vygotsky mentions that there are two types of mediating elements: instruments and signs. According to him, development occurs through interaction, which leads to learning.

Vygotski believes that the participation of others is necessary in the construction of the subject, so that they can understand their symbols. From the earliest days of a child's development, their activities acquire their own meaning in a system of social behavior and are directed towards defined goals. The path from the object to the child and from the child to the object passes through another person. [44]

We believe that mediation may be necessary for the communicative process to be effective, as it can promote communicative situations so that there is communicative intent and understanding of the context.

FINAL CONSIDERATIONS

We observed a predominance of foreign articles on the subject of CAA, studies that are relevant and guide the intervention of professionals with autistic children who have complex communication needs.

Through this study, we realized that augmentative alternative communication is part of the therapeutic intervention that enables the acquisition of speech and language in autism. It is important that family, school and society are engaged in the use of AAC, creating opportunities and generalization for effective functional communication.

We found that the application of low and high technology has good results in stimulating communication, but it is necessary to analyze the financial condition, accessibility and usability of the family with the autistic child.

In Brazil, it is important to intensify research in a consistent way, through universities, so that investigations on the subject are conducted, since functional language impacts on aspects related to inclusion, autonomy, learning and dignity of people with complex communication needs who need to achieve functional communication.

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