

Intervention models for promoting language in children with Autism Spectrum Disorder: an integrative review

Modelos de intervenção para a promoção da linguagem de crianças com Transtorno do Espectro do Autismo: revisão integrativa

Modelos de intervención para promover el lenguaje en niños con trastorno del espectro autista: una revisión integradora

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Abstract

Introduction: One of the most frequent manifestations and diagnostic criteria for autism spectrum disorder (ASD) is the limited language use for social communication. **Objective:** To conduct a bibliographic survey of the last 6 years on early intervention models used to promote the use of oral language in children with ASD. **Method:** The bibliographic research surveyed articles in the literature published from 2018 to 2023 by searching the following databases: Virtual Health Library, MEDLINE via PubMed, Scopus, Web of Science, and EMBASE. The review included studies that answered the research question and used the established descriptors, published in the last 6 years (from 2018 to 2023), approaching infants and schoolchildren up to 5 years old, with no language restrictions. It excluded articles whose full texts were unavailable. **Results:** The search using descriptors found 5,012 articles in the databases. After analysis and selection, 21 studies were included in the review based on the criteria. Their data were organized in a protocol for analysis, considering the following aspects: title, author/authors, year, country, study type, objectives, sample, model, and results. **Conclusion:** The studies

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Authors' contributions:

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Received: 01/02/2025

Accepted: 02/18/2025

used different models, methods, and approaches to stimulate the adequate development and use of oral language skills in ASD care.

Keywords: Autism Spectrum Disorder; Language Therapy; Speech, Language and Hearing Sciences; Child Language; Language Development.

Resumo

Introdução: Uma das manifestações mais frequentes e critério diagnóstico para o Transtorno do Espectro do Autismo (TEA) é a limitação referente ao uso da linguagem com vistas à comunicação social. **Objetivo:** Realizar um levantamento bibliográfico dos últimos 6 anos sobre os modelos de intervenção precoce utilizados para a promoção do uso da linguagem oral de crianças com TEA. **Método:** Para o levantamento dos artigos na literatura, a pesquisa bibliográfica realizou-se por uma busca nas seguintes bases de dados: Biblioteca Virtual em Saúde, MEDLINE via PUBMED, SCOPUS, WEB OF SCIENCE e EMBASE nos períodos de 2018 a 2023. Estudos que respondiam à pergunta norteadora e aos descritores estabelecidos, estudos publicados nos últimos 6 anos (de 2018 a 2023), grupo etário participante - lactente a escolar (até 5 anos de idade) e sem restrições em relação aos idiomas. Os artigos sem os textos completos disponíveis foram excluídos. **Resultados:** A busca realizada por meio de descritores revelou 5012 artigos nas bases de dados pré-estabelecidas, após análise e etapas de seleção, 21 estudos foram selecionados dentro dos critérios estabelecidos e foram eleitos para essa revisão. Para a análise dos artigos selecionados, as informações sobre os estudos foram organizadas, em um protocolo, considerando os seguintes aspectos: título, autor/autores, ano, país, tipo de estudo, objetivos, amostra, modelo utilizado e resultados. **Conclusão:** Foram verificados estudos com os diferentes modelos, metodologias e abordagens utilizados para promover o uso e estimular o desenvolvimento adequado das habilidades da linguagem oral na abordagem do Transtorno do Espectro do Autismo.

Palavras-chave: Transtorno do Espectro Autista; Terapia da Linguagem; Fonoaudiologia; Linguagem Infantil; Desenvolvimento da Linguagem.

Resumen

Introducción: Una de las manifestaciones más frecuentes del Trastorno del Espectro Autista (TEA) es la limitación en el uso del lenguaje para la comunicación social. **Propósito:** Realizar un relevamiento bibliográfico de los últimos 6 años sobre modelos de intervención temprana utilizados para promover el lenguaje oral en niños con TEA. **Métodos:** Se llevó a cabo una búsqueda en Biblioteca Virtual de Salud, MEDLINE vía PUBMED, SCOPUS, WEB OF SCIENCE y EMBASE (2018-2023). Se incluyeron estudios que respondieran a la pregunta guía, publicados en los últimos 6 años, con participantes de hasta 5 años, sin restricciones de idioma. Se excluyeron artículos sin texto completo disponible. **Resultados:** La búsqueda mediante descriptores reveló 5012 artículos. Tras el análisis y selección, se incluyeron 21 estudios dentro de los criterios establecidos. Para su análisis, la información se organizó en un protocolo que consideró título, autor(es), año, país, tipo de estudio, objetivos, muestra, modelo utilizado y resultados. **Conclusiones:** Se identificaron diversos modelos, metodologías y abordajes dirigidos a promover el desarrollo del lenguaje oral en niños con TEA.

Palabras clave: Trastorno del Espectro Autista; Terapia del Lenguaje; Ciencias del Habla, Lenguaje y Audición; Lenguaje Infantil; Desarrollo del Lenguaje.

Introduction

Autism spectrum disorder (ASD) is a neurodevelopmental condition, a complex neurodevelopmental disorder¹, and one of the most discussed human conditions today². The diagnostic characteristics of autism are described as impairments in social communication and the presence of restricted and repetitive behaviors³. One of the most frequent manifestations and diagnostic criteria for ASD according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-V)³ is the limited use of language for social communication³. Currently, advances in studies and research have allowed increasingly accurate early diagnosis and specific interventions for children diagnosed with and/or at risk for ASD⁴. Studies have increasingly structured and developed specific interventions with evidence-based practices (EBP) to stimulate, teach, and guide early development and skills^{5,6}. Faced with a diagnosis or suspicion thereof, the family, guided by professionals in the field, has a path to follow, and the choice of this path leads, among several aspects, to the decision on which intervention or intervention model they should choose.

This study focused on maintaining EBP principles and assisting the therapy's performance and decision-making to conduct and apply clinical practices. Thus, this integrative literature review aimed to describe evidence-based early intervention models to promote language use in children with ASD by searching studies on the topic.

Research strategy

This integrative literature review was based on national and international recommendations⁷. Following the PCC acronym (Problem, Concept,

and Context), the research question was, "What are the early intervention models used to promote the use of oral language in children with ASD?".

Other research stages were carried out after defining the research question. The first one was the descriptor identification, search, and analysis. The descriptors used from DeCS (Health Sciences Descriptors) in Portuguese and English were, "Autism Spectrum Disorder", "Language Therapy", "Speech Therapy", "Child Language", "Language Development", "Interpersonal Relations" or "Social Relationship", and "Communication Barriers". The descriptors were combined using the Boolean operators AND and OR. The articles in the literature were surveyed in the following databases: Virtual Health Library (BVS), MEDLINE via PubMed, Scopus, Web of Science, and EMBASE.

Selection criteria

The selection criteria were studies that answered the research question and met the established descriptors, published in the last 6 years (from 2018 to 2023), approaching infants to schoolchildren up to 5 years old, with no language restrictions. This period was chosen because it was an integrative review, focusing on recent research on the topic and more current publications. Articles unavailable in full text and without abstracts in English, Portuguese, or Spanish were excluded.

Data analysis

After this stage, the Rayyan⁸ reference management analyzed the data. First, duplicate articles were identified and then the titles and abstracts of the articles were read to verify whether the study met the research criteria. Then, the selected articles were read in full text, and those that met the research criteria were selected for this review.

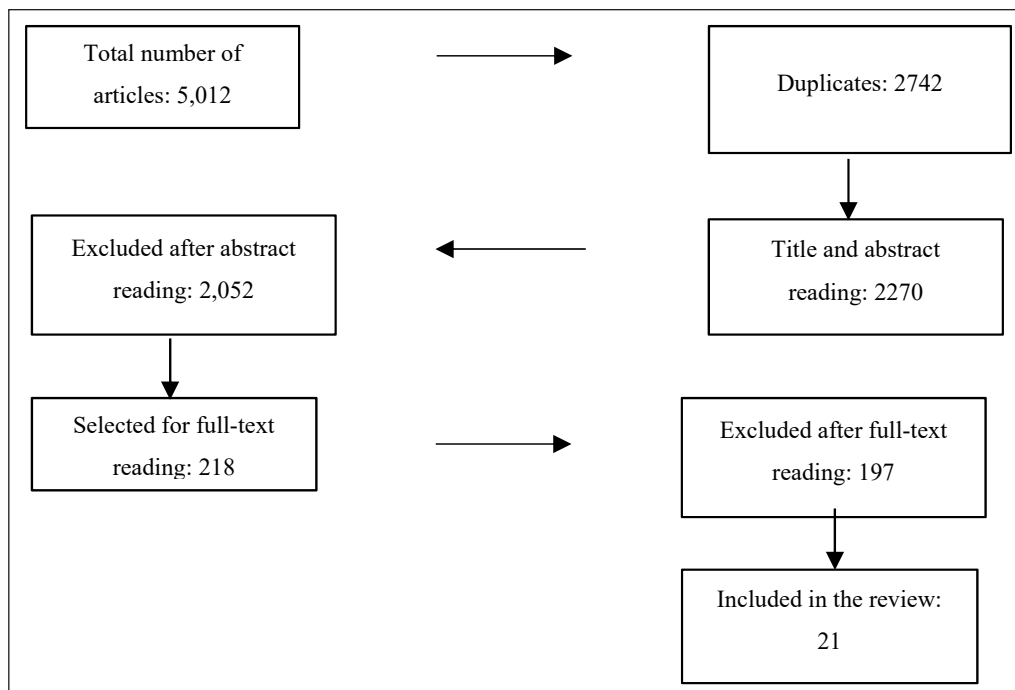


Figure 1. Prisma flowchart of study eligibility

Results

Data about the studies were organized to analyze the selected articles, considering their

title, author(s), year, country, study type, objectives, sample, model, and results. The data were arranged on a table to visualize and measure the findings better.

Chart 1. Description of selected studies

Title	Author(s)	Year	Country	Study type	Objectives	Sample	Model	Results
Reexamining Pathways Early Autism Intervention in Children Before and After the Third Birthday: A Randomized Control Trial	ROLLINS, Pamela Rosenthal; DE FROY, Adrienne M.	2023	United States of America	Randomized control trial	To verify the effectiveness of early intervention in Autism, in relation to the generalization of social communication skills and language skills	67 participants	Pathways Early Autism Intervention	- In comparison, regarding social communication, the group of children up to 3 years old showed a significantly large effect and a small effect that approached significance for the group of children over 3 years old. - There were significant results for interaction and social communication. - For speech/expressive language skills, the magnitude of the effect was small.
Teaching Caregivers to Support Social Communication: Results From a Randomized Clinical Trial of Autistic Toddlers	ROBERTS, Megan Y.; STERN, Yael S.; GRAUZER, Jeffrey; NIETZELD, Jennifer; THOMPSON, Suzanne; JONES, Maranda; KAAT, Aaron J.; KAISER, Ann P.	2023	United States of America	Multisite Parallel Randomized Controlled Trial	To examine the effects of combining two caregiver-mediated interventions on children's social communication and language.	120 caregivers and their children with ASD between 24 and 36 months of age	Hybrid intervention – EMT, JASPER or Behavior Management control condition	- There were significant differences favoring the intervention group for most intervention strategies (such as turn-taking, response time, commands, etc.). - Children in the intervention group did not engage in significantly more socially communicative acts than children in the control group immediately after the intervention.
The Role of Naturalistic Developmental Behavioral Interventions in Early Intervention for Autistic Toddlers: An Observational Study	LEE, Jordan; SONE, Bailey; ROONEY, Tara; ROBERTS, Megan Y.	2023	United States of America	Observational Study	To describe the use of NDBI strategies by Speech-Language Pathologists	25 families and their speech-language hearing therapists	NDBI	- Speech-language pathologists implemented more developmental strategies than behavioral strategies during sessions. - Practitioners reported that some common procedures of highly structured, manualized NDBIs may be incompatible with their clinical obligation to individualize goals and strategies for the families they serve in Early Intervention. - The authors propose that further studies should investigate and report on the impact of NDBIs across a broader range of communication skills and developmental domains.
A Systematic Review of the Efficacy of Early Initiation of Speech Therapy and Its Positive Impact on Autism Spectrum Disorder	OSMAN, Hafsa A; HARIDI, Merna; GONZALEZ, Natalie A; DAYO, Sana M; FATIMA, Umama; SHEIKH, Aaiyat; PUVVADA, Chaitanya S; SOOMRO, Faiza H; KHAN, Safeera.	2023	United States of America	Systematic Review	To verify the implementation of early intervention therapy for children with ASD	12 articles	ESDM and Parental Guidance	It was possible to verify that early therapy, mainly Speech Therapy used for intervention with children with ASD, demonstrated favorable results in expressive language, comprehension and communication skills.
Efficacy and moderating factors of the Early Start Denver Model in Chinese toddlers with autism spectrum disorder: a longitudinal study	WANG, Shi-Huan; ZHANG, Hai-Tao; ZOU, Yuan-Yuan; CHENG, San Mei ; ZOU, Xiao Bing; CHEN, Kai Yun.	2023	China	Randomized Study	To explore the efficacy and moderating factors of ESDM in Chinese children with ASD longitudinally.	60 participants	ESDM	- It was found that the model can effectively improve speech and communication in children with ASD after a 24-week intervention. - More importantly, it can promote social cognition and interaction and can reduce stereotypical verbal behavior in children with ASD in longitudinal observation. - The group that received the intervention showed greater elevation in verbal/pre-verbal cognition, social reciprocity and verbal behaviors.
The Effect of Early Language Intervention on Children with Developmental Language Disorders: A Case Study	HASSANATI, Fatemeh; TAVASOLI, Mojgan; JAFARI, Salime.	2022	Iran	Case study	To evaluate the effects of early language intervention	1 participant	Early Linguistic Intervention	Early intervention was essential to improve the child's communication, there was an improvement in eye contact skills, auditory and visual attention, attention and response to the name, receptive and emissive language and improvement in orofacial functions and structures.



Title	Author(s)	Year	Country	Study type	Objectives	Sample	Model	Results
Naturalistic Communication Training for Early Intervention Providers and Latinx Parents of Children with Signs of Autism	GEVARTER, Cindy; NAJAR, Adriana Medina ; FLAKE, Jennifer; TAPIA-ALVIDREZ, Felicia; LUCERO, Alixandria.	2022	United States of America	Experimental Study	To implement a brief training and coaching program in naturalistic developmental behavioral intervention	9 participants (3 groups including the early intervention provider, a father and his young son with ASD)	NDBI	- It was possible to verify the increase in the number of target communication turns between parents and children. - All three children showed higher rates of communication responses, expanding the interaction.
Use of a robust alternative communication system in autism spectrum disorder: a case report	MONTENEGRO, Ana Cristina de Albuquerque; SILVA, Leticia Karine Silvestre de Melo; BONOTTO, Renata Costa de Sá; LIMA, Rafaela Asfora Siqueira Campos; XAVIER, Ivana Arrais de Lavor Navarro.	2022	Brazil	Case Report	To investigate the impact of using a robust AAC system on the communication of a child with ASD	1 participant	DHACA	- It was possible to verify that receptive, expressive and behavioral communication skills showed growth of 62.5, 36.84 and 55.53%, respectively. - Therefore, positive results were observed in the development of communication with the use of AAC during the intervention, verified in the advancement of receptive and expressive communication skills, as well as behavioral skills.
Efficacy of family rehabilitation treatment performed by parents under the guidance of professionals in children with autism spectrum disorder: A prospective study	ZHANG, Ya-Ru; TAO, Hong-Mei; YANG, Guang; WANG, Yi; SHA, Lin; SHAO, Zhi.	2021	China	Prospective Study	To study the effectiveness of family rehabilitation treatment carried out by parents under the guidance of professionals in children with ASD	60 participants	Parental Guidance Program based on ABA and PRT principles	- Parents of children in the conventional group received online training on basic knowledge and rehabilitation training for ASD, while those in the observation group received online training and underwent family rehabilitation treatment under the guidance of a professional team. - Compared with the conventional group, the observation group showed significant increases in scores for the dimensions of language comprehension, language expression, gross motor skills, fine motor skills, self-care ability in daily life, and adaptive behavior.
The Efficacy of Pivotal Response Treatment in Teaching Question-Asking Initiations to Young Turkish Children with Autism Spectrum Disorder	BOZKUSGENC, Gulden; YUCESOYOZKAN, Serifa	2021	Turkey	Randomized Study	To evaluate the effectiveness of PRT in the acquisition, maintenance, and generalization of question initiations	4 participants	PRT Model	- PRT was found to be highly effective in teaching question initiations. - Participating children with ASD were able to generalize across natural settings and maintain question initiations over the long term.
Looking back and moving forward: A scoping review of research on preschool autism interventions in the field of speech-language pathology	BINNS, Amanda V; SMITH, Rachael; ANDRES, Allison; LAM, Joyce; CARDY, Janis Oram.	2021	Canada	Scoping Review	The review examined the state of research in the field of speech-language pathology and interventions for preschool autism in order to identify the types of studies that could be used to inform speech-language pathologists' practices.	114 articles	Mapping speech-language-hearing therapy performance	- The most frequently reported intervention programs were child-centered naturalistic developmental models, followed by interventions based on applied behavioral principles and hybrid approaches that combine aspects of behavioral and naturalistic developmental models. - AAC was widely used, with PECS being the most prominent.
Contribuições da comunicação alternativa no desenvolvimento da comunicação de criança com transtorno do espectro do autismo	MONTENEGRO, Ana Cristina de Albuquerque; LEITE Gabrielle Araújo; FRANCO, Natália de Melo; SANTOS, Debora dos; PEREIRA, Jakciane Eduarda Araújo; XAVIER, Ivana Arrais de Lavor Navarro.	2021	Brazil	Case Report	To demonstrate the contributions of using a high-tech AAC system in the development of the communication skills of a child with ASD	1 participant	DHACA	- Improvements were observed in the scores of the assessment instruments, regarding the skills of expression, comprehension and social interaction. - An increase in the child's vocabulary was observed, with the acquisition of new lexical categories; requesting objects out of visual range, using AAC. - In addition, improved social communication in the family and educational context.



Title	Author(s)	Year	Country	Study type	Objectives	Sample	Model	Results
Generalized Effects of Naturalistic Social Communication Intervention for Minimally Verbal Children with Autism	HAMPTON, Lauren H.; KAISER, Ann P.; NIETFIELD, Jennifer P.; KHACHOYAN, Ani.	2020	United States of America	Case Report	The study examined the effects of naturalistic interventions on social language use in three children with autism who were in the early stages of language acquisition.	3 participants	Combined EMT and JASPER interventions	- Blended intervention is effective in increasing social language for young children with ASD. - However, generalization to communication partners does not occur readily.
Effects of pivotal response treatment on reciprocal vocal contingency in a randomized controlled trial of children with autism spectrum disorder	MCDANIEL, Jena; YODER, Paul; CRANDALL, Madison; MILLAN, Maria Estefania; ARDEL, Christina Mich; GENGOUX, Grace W; HARDAN, Antonio Y.	2020	United States of America	Randomized Controlled Trial	To assess reciprocal vocal contingency after intervention	48 participants	PRT Model	The effectiveness of PRT in vocal reciprocity in children with ASD is evident, which may be a fundamental skill for language development.
Multi-component communication intervention for children with autism: A randomized controlled trial	HAMPTON, Lauren H; KAISER, Ann P; FULLER, Elizabeth A.	2020	United States of America	Randomized Controlled Trial	To evaluate the effectiveness of a multicomponent communication intervention on social communication for young children with autism	68 participants	Multicomponent Communication Intervention consisting of JASPER, EMT, speech generating device, DTT and Caregiver Training	- Children in the intervention group demonstrated significantly greater joint attention than those in the control group immediately after the intervention. - In addition, children in the intervention group demonstrated greater social communication with their caregivers 4 months after the intervention.
Augmentative and Alternative Communication on Autism Spectrum Disorder: Impacts on Communication	PEREIRA, Erika Tamayres; MONTENEGRO, Ana Cristina de Albuquerque; ROSAL, Angélica Galindo Carneiro; WALTER, Cátia Crivelenti de Figueiredo.	2020	Brazil	Longitudinal case study	To verify the effects of speech therapy intervention with AAC on the communicative acts of children with ASD	3 participants	PECS	It was found that there was greater quality in the communicative acts produced, using more present verbal components and a reduction in acts that had non-interpersonal functions, such as gestures and vocal acts. Thus, there was an evolution in the subjects' functional language.
Developmental social pragmatic interventions for preschoolers with autism spectrum disorder: A systematic review	BINNS, Amanda V.; CARDY, Janis Oram.	2019	Canada	Systematic review	To differentiate and examine the impact of developmental social pragmatic interventions on the social communication and language skills of preschool children with ASD	10 studies	Pragmatic Social Development Interventions	- Although the results were positive for language use in natural contexts, they were mixed for general, receptive and expressive language, requiring more robust data. - A positive impact on children's fundamental communication skills (i.e. attention, social referencing, joint attention, initiation, reciprocity) is suggested. - Parental interaction styles changed significantly after the intervention, in terms of increased responsiveness, synchronous behavior, use of affect and decreased directiveness.
Evidenced-Based Interventions for Children With Autism Spectrum Disorder	WILL, Meredith N.; CURRANS, Kristn; SMITH, Jennifer; WEBER, Stephanie; DUNCAN, Amie; BURTON, Jenny; KROEGER-GEOPPINGER, Kimberly; MILLER, Valerie; STONE, Megan; MAYS, Lindsay; LUEBRECHT, Ashley; HEEMAN, Anna; ERICKSON, Craig; ANIXT, Julia.	2018	United States of America	Systematic Review	To provide an overview of evidence-based interventions for children with ASD in the specialties of Psychology, Speech-Language Pathology, Occupational Therapy, and Developmental Pediatrics	775 articles	Approaches described for Speech-Language Pathology Intervention: ABA, Language Modeling Strategies and PECS	- Interventions vary in their level of evidence-based support. - Although disciplines may differ in their definitions of evidence-based treatments, it is important that each discipline strive to provide and promote practices with the best evidence-based support, according to the standards of each discipline..

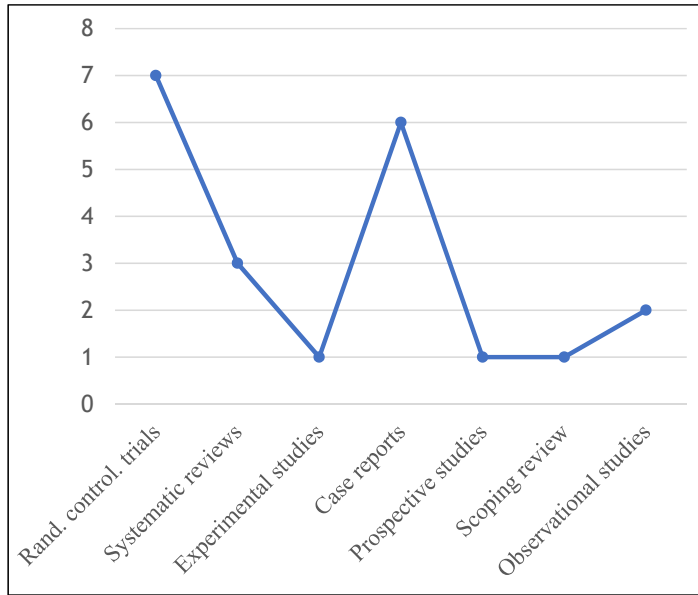
Title	Author(s)	Year	Country	Study type	Objectives	Sample	Model	Results
Incorporating a Peer-Mediated Approach Into Speech-Generating Device Intervention: Effects on Communication of Preschoolers With Autism Spectrum Disorder	THIEMANN-BOURQUE, Kathy; FELDMILLER, Sarah; HOFFMAN, Lesa; JOHNER, Stacy.	2018	United States of America	Multivariate Randomized Controlled Trial	This study examined the effects of incorporating a peer-mediated approach into a speech-generating device intervention on the communication of preschoolers with ASD.	45 nonverbal and minimally verbal preschoolers with ASD and 95 typically developing peers	Peer-mediated approach in an intervention with a speech-generating device	- Positive effects on communication have been reported when young children with ASD and typically developing peers are taught to use the same speech-generating device system in typical preschool activities. - Children who received treatment demonstrated significant increases in communication rates and more balanced responses and initiations, were able to generalize improvements, and were able to maintain communication gains. - Significant increases in intentional communication were observed for both communication partners, and children were able to generalize and maintain these skills compared to children in a comparison group who did not have trained peers.
Integrating a Parent-Implemented Blend of Developmental and Behavioral Intervention Strategies into Speech-Language Treatment for Toddlers at Risk for Autism Spectrum Disorder	RIETH, Sarah R; HAINE-SCHLAGEL Rachel; BURGESSON, Marilee; SEARCY, Karyn; DICKSON, Kelsey S; STAHLER, Aubyn C.	2018	United States of America	Observational Study	To promote the use of parental coaching in community-based early intervention programs	25 therapists, including speech-language-hearing pathologists	Project ImPACT for Toddlers	- Project ImPACT for Toddlers is an approach to address the need for increased parent training by including speech-language therapy sessions. - The project envisions that interventionists can learn to build rapport with the parents and caregivers of the children they treat to improve children's communication and developmental outcomes.
A communication intervention in autism spectrum disorder by means of the programme 'More than Words'. A case study	BAIXAULI-FORTEA; Inmaculada; GASCON-HERRANZ, Nerea; DE CARLOS-ISLA, Mercedes; COLOMER-DIAGO, Carla.	2018	Spain	Case Study	To describe the effects of the program on the communication and language skills of a child with ASD	1 participant	Hanen - More than Words Program	- The intervention can positively modify the parents' communication style, especially when the family receives guidance from the speech therapist. - However, the responsive nature of the parents' communication tends to decrease when the intervention ends. - As a medium-term effect of the treatment, the child's communicative acts increase.

The search guided by the descriptors found 5,012 articles, of which 2,742 were duplicates, resulting in 2,270 articles for title and abstract reading. Then, 2,052 articles were excluded, and 218 were selected for reading in full. Hence, 21 studies were selected for the review based on the established criteria. They were published between 2018 and 2023.

Most studies (11) that met the criteria and answered the research question were from the United

States of America⁹⁻¹⁹, while three were from Brazil^{2,20,21}, two each from China^{22,23} and Canada^{24,25}, and one each from Iran²⁶, Spain²⁷, and Turkey²⁸.

Their methodological types were randomized controlled trials^{9,10,15,16,18,22,28}, observational studies^{11,19}, systematic reviews^{12,17,25}, experimental studies¹³, case reports^{2,14,20,21,26,27}, prospective studies²³, and scoping reviews²⁴. These results were illustrated (Figure 2) for better visualization.



Source: Developed by the authors

Figure 2. Methodological types of the articles included in the review

Discussion

The samples of the selected studies met the age range criterion – infants to schoolchildren up to 5 years old. The studies that analyzed articles included 10 to 775 articles. The number of participants per study ranged from 1 to 68. One study¹⁰ had a sample of 120 caregivers and their children diagnosed with ASD, while another study¹⁸ compared 45 nonverbal and minimally verbal preschoolers with ASD with 95 typically developing peers. One study¹¹ had a sample of 25 families and their respective speech-language-hearing pathologists, and another¹³ had nine participants – three groups with an early intervention provider, a parent, and the young child with ASD. One systematic review included 12 articles¹², another used 10 studies²⁵, a scoping review used 114 articles²⁴, and another review had 775 articles¹⁷.

The studies described the following intervention models: Applied Behavior Analysis (ABA); Augmentative and Alternative Communication (AAC); Picture Exchange Communication System (PECS); Development of Communication Skills in Autism (DHACA); Early Start Denver Model (ESDM); Pathways Early Autism Intervention; Early Language Intervention; Social Pragmatic

Developmental Interventions; Language Modeling Strategies; Parental Guidance and Caregiver Training; Pivotal Response Treatment (PRT); Parental Guidance Program based on the principles of ABA and PRT; Peer-mediated approach in an intervention with a speech-generating device; JASPER Model (The JASPER Model for Children with Autism: Promoting Joint Attention, Symbolic Play, Engagement, and Regulation); More Than Words Program (More Than Words – Hanen Program) (MTW); Enhanced Milieu Teaching Communication Intervention (EMT); and Naturalistic Developmental Behavioral Intervention (NDBI). However, not all models described in and used by the selected studies are validated in EBP for intervention in autism^{4,29}.

The selected articles used a wide variety of ASD intervention models. Two studies used the ESDM^{12,22}, one associated with Parental Training and Guidance¹². The study demonstrates that the model considers behavioral, relational, and developmental aspects and is implemented for early intervention in young children and preschoolers with ASD. Besides being an NDBI model, the study identified it as a promising, cost-effective intervention widely used in current interventions²⁹. The results of the studies demonstrated that early intervention with this model, associated

with speech-language-hearing therapy, had favorable results in communication and comprehensive and expressive oral language²². These studies were conducted in different countries and demonstrated the effectiveness of the ESDM model^{12,22}.

According to studies, ABA currently has great scientific support. It has been one of the most researched sciences to promote the development of children with ASD, and several behavioral models and interventions derive from it, which are the basis of interventions considered the gold standard for ASD^{1,6}. Speech-language-hearing therapy can also act on verbal behavior, as long as it follows the ABA precepts, which help achieve the objectives according to the patient's therapeutic plan¹⁷.

AAC defines other communication possibilities that replace, complement, and/or supplement the functions of language^{2,20,21}. Various approaches and programs have been developed to acquire functional communication. PECS, cited in two studies, is an AAC system developed in the USA in 1985 by Andy Bondy and Lori Frost. The system has six phases, teaching how to exchange figures (of an item or action) with a communication partner, progressively expanding to the more advanced teaching of dialogues¹⁷. Modeling, also presented and organized by the ABA precepts, aims to teach and direct the use of PECS within the functional context¹⁷. The study results describe the participants' evolution of functional language and improvement in the quality of communicative acts, demonstrating that they achieve the objective of PECS. Hence, it is an adequate approach for promoting communication according to the studies^{17,21}.

The selected articles also used the DHACA method, developed by Brazilian speech-language-hearing pathologist and professor Ana Cristina Montenegro^{2,20}. It has not yet been validated according to EBP criteria and principles, but future studies will aim to validate the methodology^{2,20}. It is based on the socio-pragmatic perspective to develop communication skills. It can be used in two versions: a communication board with movable figures and a flipbook with fixed figures, usable as low and high technology resources². Two selected studies presented DHACA intervention results^{2,20}, including improvements in social communication in the contexts to which the children belong. They found an increase in the participants' vocabulary and improvement in communication and behavioral skills^{2,20}. Various analyses aimed to map and verify

speech-language-hearing studies to inform about their practices; one such review demonstrated that the most described and analyzed practices supported social communication, language, and AAC use with autistic children. In addition, many studies used PECS²⁴.

One study¹⁸ demonstrated the use of an AAC system through a peer-mediated approach in an intervention with a speech-generating device. It used an Apple iPad 2 with speech output and different applications. Recent research demonstrates that this type of AAC system has empirical support for improving communication, and speech-generating devices allow peers to be responsive communication partners, increasing the participation of children with ASD in educational settings, improving their social skills and acceptance of children, as others use AAC¹⁸. An interesting finding of this study is the significant increase in intentional communication by communication partners. Moreover, the children generalized and maintained these skills, contrasting with children in a comparison group without trained peers¹⁸.

The MTW, a pragmatic social intervention program focused on the family, was used in one of the studies²⁷. It trains parents as facilitators of their children's social communication development by creating and expanding opportunities for children to develop their communication skills in everyday situations. According to the study, the program promotes and expands children's communicative acts, positively changing the parents' communication style²⁷.

Another model cited and studied is the PRT^{15,28}, considered a promising NDBI model for intervention with children with ASD. PRT focuses on areas essential to development. The effectiveness of PRT model strategies was investigated to verify their validity in teaching question initiation to children with ASD. As a result, it proved effective to this end, and the children participating in the study could generalize this skill in natural environments and maintain it in the long term²⁸.

Another study aimed to evaluate reciprocal vocal contingency after intervention using the PRT model¹⁵. The study considers reciprocal vocal contingency as an automated vocal reciprocity measure derived from audio samples collected during a day in the child's natural environment. The study analyses showed that the PRT increased the vocal reciprocity of children with ASD, which is a

very important and relevant finding since this skill is crucial for language development¹⁵.

A study used early language intervention to evaluate its effects²⁶, which included improvements in the child's communication and other skills, such as eye contact skills, auditory and visual attention, attention and response to the name, receptive and emissive language, and improved orofacial functions and structures²⁶.

A study examined the Pathways Early Autism Intervention, an intensive, community-based, parent-mediated NDBI program for children with ASD⁹. It compared two groups of children (up to and over 3 years old) and verified that the group of children up to 3 years old had a significantly large effect in social communication (greater than the results of the group of children over 3 years old), showing results with a small effect that approached significance. These data support the importance and need for early intervention⁹.

Another study demonstrated favorable results for stimulating language use and achieved a positive effect on skills essential for children's communication after using developmental social pragmatic interventions²⁵. An interesting result that this study demonstrates is the change in the parents' interaction styles, modified and improved positively after the intervention, with greater responsiveness, synchronous behavior, affection, and decreased directive capacity²⁵. This result shows and supports the importance of parental guidance. Another study likewise demonstrates the relevance of parental guidance (also called parental coaching)²⁴. A Chinese study²³ organized a Parental Guidance Program based on the ABA and PRT principles. For research and analysis, the sample was divided into two groups, a conventional and an observation group. The parents of the children in the conventional group received online training on basic knowledge and ASD rehabilitation, and those in the observation group received online training and underwent family rehabilitation treatment under the guidance of a professional team. Compared to the conventional group, the observation group significantly increased their scores in language comprehension, language expression, gross motor skills, fine motor skills, self-care skills in daily living, and adaptive behavior²³. The ImPACT for Toddlers Project also advocates using parental coaching in community-based early intervention programs, with diverse knowledge and strategies

from different theoretical (developmental and behavioral) approaches. In addition to the gains in children's skill development, the project describes its broad applicability to early intervention professionals in multiple disciplines (including speech-language-hearing therapy), guiding on specific child goals in parent-child interactions and their daily routines, leading to generalized learning¹⁹. NDBI strategies were used to create a brief training and coaching program in naturalistic developmental behavioral intervention involving parents, children, and development specialists (two specialists had a bachelor's degree in early childhood education, and one specialist had a bachelor's degree in human services). The literature currently describes that the development of pre-linguistic skills benefits from NDBI strategies. As a result of the study, children increased the number of communicative turns and expanded communication¹³. Therefore, parental guidance programs produce positive results by expanding children's skills, improving family relationships, and promoting behavior management. Some studies combined approaches to produce hybrid intervention^{10,14,16}. The naturalistic language intervention that promotes the functional use of new forms of language in daily interactions with caregivers and teachers is known as EMT. The behavioral development approach that teaches the foundations of social communication (joint attention, symbolic play, and regulation of others through nonverbal comments and requests) in the context of social play is known as the JASPER model. One study¹⁰ combined these two approaches to generate a combined intervention (JASP-EMT) – the JASPER to teach the social foundations of communication and the EMT to teach spoken language¹⁰. A group of researchers¹⁰ set out to examine the effects of combining these two interventions, mediated by the caregiver or a behavior management control, regarding the child's social communication and language. The results showed significant differences favoring the intervention group for most intervention strategies (such as turn-taking, response time, commands, etc.). The children in the intervention group did not perform significantly more socially communicative acts than those in the control group immediately after the intervention¹⁰. Similarly, another study that used the same combined intervention examined its effect on the social use of language in children in the early stages of language acquisition. The results indicate

that the combined intervention positively expanded the target social language in small children with ASD¹⁴. Many interventions are combined to help them develop skills. Researchers put together a Multicompetence Communication Intervention, in which they associated the JASPER, EMT, speech-generating device, DTT, and Caregiver Training models. After the intervention, the intervention group obtained significantly better results in joint attention and improved social communication with their caregivers¹⁶.

According to a study conducted in the United States of America¹¹, NDBI interventions facilitate the development of social communication in children with ASD. However, in some cases, as described in the study, highly structured protocols may pose a barrier, leading speech-language-hearing pathologists to individualize the intervention according to family-centered principles¹¹. Thus, speech-language-hearing pathologists implemented more developmental than behavioral strategies during their sessions. This may be due to speech-language-hearing objectives and performance¹¹. However, professionals report difficulty in using manualized gold-standard practices, referring to the difficulty in maintaining the collection routine. This leads to modifying and individualizing goals and strategies to their patients and families' objectives¹¹.

Conclusion

This study described the various approaches, methodologies, and timely intervention models published in scientific databases over the last 5 years. The models most cited in the studies were EMT, JASPER, AAC, and NDBI, used by professionals with a common goal: to promote the use and stimulate the adequate development of oral language skills in their approach to ASD. The most varied models demonstrate several intervention possibilities. Most models have been validated and were structured and evaluated through EBP.

More structured studies are needed to understand the use of NDBI strategies in speech-language-hearing practices and to investigate their results regarding the field of study and speech-language-hearing performance in language and speech skills and competencies.

Further studies and research are warranted, especially studies with great relevance and a better scale of evidence, in different social contexts, coun-

tries, and populations, to disseminate promising, effective, and well-founded intervention models. Hence, this quality intervention may be offered to children diagnosed with ASD, providing better functional communication, expansion of communicative skills, and a better quality of life.

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