Literature Review

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# Optimizing language development in hearing-impaired children - the impact of family-centered interventions: a systematic review

## Otimizando o desenvolvimento da linguagem em crianças com deficiência auditiva - o impacto das intervenções centradas na família: uma revisão sistemática

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## ABSTRACT

**Purpose**: To evaluate whether family-centered intervention has an effect on the language development of hard of hearing children. **Research strategies**: A systematic literature review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) by searching six databases (Cochrane, LILACS, PsycINFO, PubMed, Scopus, Web of Science, EMBASE) and the gray literature (Google Scholar), without language or year restriction. **Selection criteria**: Studies were eligible if they had a control group and/or compared pre- and post-intervention tests focused on parents' efforts to improve communication and language development in their children with hearing impairment. Two independent reviewers worked on data selection and analysis. Data analysis: Six articles that met the eligibility criteria were included and all of them had a low risk of bias. Regarding the level of evidence, two were classified as high risk and four as low risk. The studies varied regarding the model of family-centered interventions. **Results**: More than one intervention was found, namely: Muenster Parental Program (MPP), Parent–Child Interaction Therapy (PCIT), Videofeedback-guided intervention and early intervention programs. In all of them, the results regarding family-child interaction and communication were beneficial, with language measures or family language inventories indicating improvement in the children's language skills. **Conclusion**: The intervention focused on families, regardless of the model, enhances the linguistic development of children with hearing impairment.

**Keyword:** Family; Child; Parent–child relationships; Hearing loss; Language development

## RESUMO

**Objetivo:** Avaliar se a intervenção centrada na família tem efeito no desenvolvimento da linguagem de crianças com deficiência auditiva. **Estratégia de pesquisa:** Foi realizada uma revisão sistemática da literatura seguindo os Principais Itens para Relatar Revisões sistemáticas e Meta-análises (PRISMA), por meio da busca em seis bases de dados (Cochrane, LILACS, PsycINFO, PubMed, Scopus, Web of Science, EMBASE) e na literatura cinzenta (Google Scholar), sem restrição de idioma ou ano. **Critérios de seleção:** Os estudos eram elegíveis se tivessem um grupo controle e/ou comparassem testes pré e pós-intervenção focados nos esforços das famílias para melhorar a comunicação e o desenvolvimento da linguagem de seus filhos com deficiência auditiva. Dois revisores independentes trabalharam na seleção e análise dos dados. Análise dos dados: Foram incluídos seis artigos que preencheram os critérios de elegibilidade e todos apresentaram baixo risco de viés. Em relação ao nível de evidência, dois foram classificados como de alto risco e quatro como de baixo risco. Os estudos variaram quanto ao modelo de intervenções centradas na família. **Resultados:** Foram encontradas mais de uma intervenção, sendo elas: *Muenster Parental Program (MPP), Parent-Child Interaction Therapy (PCIT)*, intervenção guiada por *feedback* de vídeo e programas de intervenção precoce. Em todos eles, os resultados quanto à interação e comunicação família-criança foram benéficos, com medidas ou inventários de linguagem com as famílias indicando melhora nas habilidades de linguagem das crianças. **Conclusão:** A intervenção focada nas famílias, independente do modelo, potencializa o desenvolvimento linguístico de crianças com deficiência auditiva.

**Palavras-chave:** Família; Criança; Relações pais-filho; Perda auditiva; Desenvolvimento da linguagem

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## INTRODUCTION

Hearing loss disrupts interactions between families and their hearing-impaired children. This disruption after the diagnosis of hearing loss in childhood is documented by studies that address the lack of opportunities for the development of auditory skills and oral language in this population, even when children use an electronic hearing aid[1-4].

Based on this, it is essential to understand the scientific evidence that can support the most appropriate clinical intervention[5-15], considering that parents spend much time with their children and can stimulate language development[16] by maximizing communication opportunities in everyday situations[17,18]. In view of this, interventions focused on the families of children with hearing impairment have been highlighted in recent studies and recommendations, and the multiple factors that influence the success of the intervention are still under investigation, with no public policy demonstrating its impact on language development in this population[19-21]. However, the World Health Organization has made available a model of a parental training program with guidance for families of children aged two to nine with delays or disabilities, to stimulate communication[22].

This research is justified in order to demonstrate the impacts of family-centered intervention on childhood auditory rehabilitation, more specifically on the development of language in children with hearing impairment.

## OBJECTIVE

Therefore, the objective of this study, performed through a systematic literature review, was to evaluate whether family-centered intervention has an effect on the language development of children with hearing impairment.

## RESEARCH STRATEGY

The present study was guided by the following question: "Does family-centered intervention have an effect on the language development of children with hearing impairment?" Based on the analysis of publications containing a control group and/or a comparison of pre- and post-interventions, involving specific therapies targeting the families of children with hearing impairment and measuring the results from questionnaires administered to parents or tests given to children, we gathered evidence that could guide future studies on this topic and contribute to clinical practice.

About sources of information and search strategy, reviewers 1 (LFG) and 2 (JSB) with the help of the subcoordinator (KVMT) of this review had performed a previous search of the literature. Through this research, the Health Sciences Descriptors (DeCS/MeSH) were chosen regarding the most recurrent free terms in studies on this topic so that the combinations between them could be made. In addition, appropriate and unique strategies were defined for each of the following databases: Cochrane, LILACS, PsycINFO, PubMed, Scopus, Web of Science and EMBASE. To broaden the scope of the research, the references of the selected studies were examined to find related articles.

A search was also conducted on the gray literature, including Google Scholar. In the Google Scholar survey, only the first 100 results were included for analysis.

In addition, the expert was consulted to improve the research results, following the recommendations of Greenhalgh and Peacock[23].

The search strategies and descriptors are presented, with booleanos AND OR: "infant", "child", "Early Intervention, Educational", "hearing loss", "cochlear implants" (Appendix 1).

The references were managed using Mendeley Desktop software.Duplicate articles were removed, and the titles and abstracts of the studies selected for analysis in phase one were analyzed using the Rayyan QCRI web application[24]. All database searches were performed on July 30,2019 and, except PsycINFO, updated on June 06, 2024. The PsycINFO database was updated in March 2022, as in the last update there was no longer access.

## SELECTION CRITERIA

A systematic literature review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)[25]. Studies were eligible for inclusion in this review if they met the following criteria according to PICOS (Population, Intervention, Comparison, Outcome, and Study design)[25]: studies conducted with children younger than 18 years old (Population) who received clinical treatment with parental presence in the operating room (Intervention) compared with the experience when parents were absent (Comparison) to determine behavior including cooperation (Outcome). To be included, the study had to present randomized, nonrandomized controlled clinical trials or cohort type observational studies. Only studies presenting some objective or subjective measurement of behavior and/or anxiety and fear were included.

Studies that included family members or parents of children with hearing impairment were eligible. The studies were required to present an intervention or exposure focused on health education (educational sources such as videos or courses for parents) or specific therapies such as video interaction guidance or parent–child interaction therapy, the latter known as Parent–Child Interaction Therapy (PCIT). No language or publication time restrictions were applied.

Studies were excluded according to the following criteria: studies of adults and elderly individuals with hearing loss; studies that did not evaluate the approach with pre- and post-intervention measures; studies that did not have any comparison or control; studies that did not use a language assessment measure and/or a questionnaire administered to parents about the language development of their children; reviews, letters, books, conference abstracts, case reports, case series, opinion articles, technical articles and guidelines.

## DATA ANALYSIS

The study selection process was performed in two phases. In phase one, two independent reviewers (LFG and JSB) read the titles and abstracts of all references collected independently and applied the eligibility criteria. In this stage, studies that did not meet the inclusion criteria were excluded.

Subsequently, in phase two, the same two reviewers (LFG and JSB) read the full text of the publications selected in phase one. In the two phases, any disagreement was resolved by the two reviewers (LFG and JSB) in discussions until they reached a mutual agreement. In cases where the two reviewers (LFG and JSB) could not reach an agreement, the third reviewer (MCOL) would have assisted in the final decision, but this was not necessary. The final selection was based on the full text of the publications.

For risk of bias in each study, the methodological quality of the included randomized clinical trials (RCTs) was analyzed using the Cochrane Collaboration tool, which evaluates the risk of bias, taking into account the following aspects: generation of the random sequence; concealment of allocation; blinding of outcome evaluation; incomplete outcomes; report of selective outcome; and other sources of bias[26].

Nonrandomized clinical trials (non-RCTs) were analyzed using the ROBINS-I tool to evaluate the following domains: confounding bias, study population, classification of interventions, bias due to deviations from the intended interventions, lack of data, measurement of results and selection of the reported result[27].

Two reviewers (LFG and JSB) performed the risk-of-bias assessment separately and judged the included articles, marking each article as low risk, uncertain risk or high risk of bias. When necessary, disagreements were resolved through discussion with a third reviewer (KVMT). W Revman 5.4 software[28] was used to generate the figures.

The summary risk of bias evaluation according to Cochrane's tool to assessed risk of bias in randomized controlled trials (RevMan 5.3, The Nordic Cochrane Centre, Copenhagen, Denmark - The Cochrane Collaboration 2014)[28] in the randomized and not randomized studies was describe like "low risk of bias", " unclear risk of bias", "high risk of bias" considering the following criteria: random sequence generation (selection bias); allocation concealment (selection bias); blinding of participants and personnel (performance bias); blinding of outcome assessment (detection bias); incomplete outcome data (attrition bias); selective reporting (reporting bias); other bias.

A summary of the quality of evidence and recommendation strength of the selected studies was performed using the GRADE system (Grading of Recommendations Assessment, Development and Evaluation)[29,30].

For Protocol and record, the systematic review is registered in PROSPERO (Prospective Registry of Systematic Reviews - Center for revisions and dissemination of the University of York, Heslington, York, United Kingdom, and the National Institute of Health Research, London, United Kingdom)[31] with the following number: record: CRD42020150848. Other information: None.

## RESULTS

A total of 3.050 citations were identified through seven electronic databases. With the removal of duplicate studies, 2,383 citations remained. In the search conducted in Google Scholar, 830 were found.

In phase one, the titles and abstracts were evaluated, and 2,372 studies were excluded. Nine studies remained for analysis in phase two, with eight studies selected from the main electronic search and one from Google Scholar. Subsequently, four articles were excluded from the nine for various reasons (Appendix 2), leaving only six articles for qualitative analysis. Of the six selected, five were from the main electronic database and one was from Google Scholar. A flowchart containing information on the identification, selection, eligibility criteria and inclusion of articles is shown in Figure 1.

For any study, the reviewers needed to be able to contact the authors to obtain unpublished information.

Of the six selected studies, one was from Australia[32], two were from the United States[33,34], one was from Germany[35], one was from Italy[36] and one was from Iran[37]. The sample ranged from 30[37] to 14[32] participants.

All selected articles had a control group[32,35-37]. One of the studies used the Muenster Parental Program (MPP) as its intervention methodology[35]. Another used the Parent–Child Interaction Therapy (PCIT) model, a therapy in which the parents receive guidance during interactions with the child[34]. Another study applied specific Parent Training (PT) programs based on *It Takes Two to Talk* (ITTT) developed for children with language delay, which empowers family-child interactions and enables parents as facilitators of language for their children[36]. One study used *video feedback*[32]. Six studies analyzed the effectiveness of the proposed intervention through scales involving analysis of the interaction or behavior of the father with his child[32-36] and language[34,36,37]. The descriptive summary of the selected studies is shown in Table 1.

The risk of bias among the randomized clinical trials did not vary between each individually evaluated domain[33,37] while a nonrandomized clinical trial showed a difference in risk of bias between the domains analyzed: generation of random sequence, concealment of allocation, blinding of outcome evaluation, incomplete outcomes, report of selective outcome and other sources of bias[32,34-36]. A meta-analysis was not performed, given the heterogeneity among the studies.

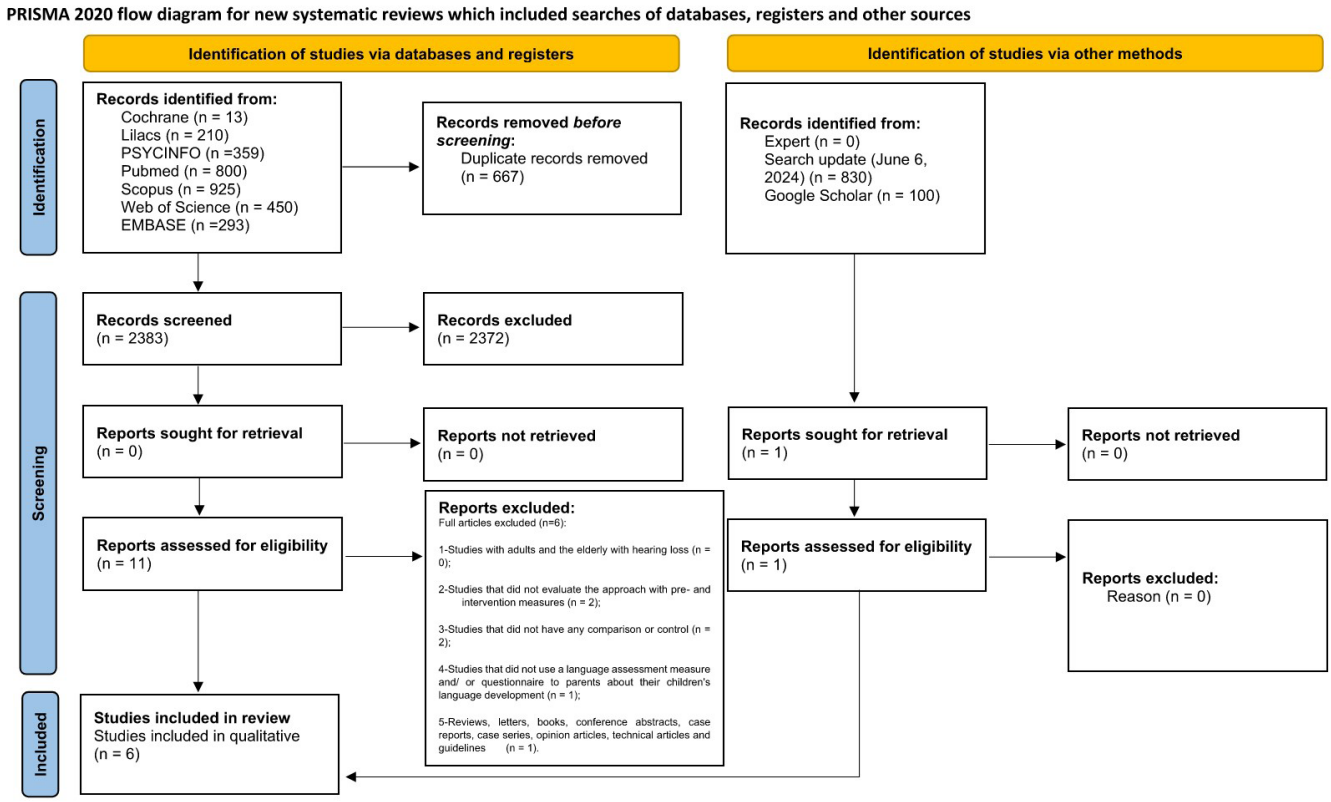
Regarding the risk of bias in individual studies, the two randomized clinical trials showed a high risk of bias: 42,8%[33,37]. Nonrandomized studies were classified as having a low risk of bias: 75%[32,34-36]. The major limitations of the three nonrandomized clinical trials[32,34,35], except for one[36], were related to the "classification of interventions". In one study, the intervention was not fully described, and the same study presented the analysis of the results through behavioral evaluation, without mentioning a specific questionnaire, scale or evaluation protocol, only the description of the measures applied[35].

The complete analysis of randomized and nonrandomized clinical trials, which determines the quality of the selected articles, is shown in Figure 2 and 3, Appendix 3 and Appendix 4.

For reporting biases, the two randomized clinical trials had a high bias risk of 42,8%. Performance, allocation, general sequence of randomization and detection of risk of bias were classified as high. Conversely, attrition and reports of the studies were identified as having a high risk of bias[33,37].

Nonrandomized studies were classified as low risk of bias: 75%. The domain of confoundability was presented as low for all of these and not evaluable for the item of deviations from the interventions. The following topics were given the classification of low risk of bias: selection of study participants, classification of interventions, missing data, measurement of results and reporting of results[32,34-36].

For certainty of evidence, the analysis of these studies with regard to GRADE 30 was segmented into randomized and




*From:* Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71. For more information, visit: http://www.prisma-statement.org/

**Figure 1.** Flowchart demonstrating the search and selection criteria of studies

nonrandomized studies and subdivided into the assessment of the language of the child and the communicative ability of the parents or family. Among them, the risk of bias was considered severe due to the allocation and randomization of studies; inconsistency as severe, as there is no standardization of the protocols; indirect evidence was not serious; and inaccuracy was severe, since the sample number was less than 300 30 for the groups and there was no publication bias[32-37].

From the analyses, following the GRADE criteria[30], the two randomized articles presented a very low level of evidence[31,35]. The four nonrandomized studies also had a very low level of evidence[32,34-36] (Table 2).

## DISCUSSION

Then, this systematic review sought to investigate the evidence that family-centered intervention has an effect on the language development of children with hearing impairment.

Of the 2,383 studies found in the databases, 2,372 were excluded in phase one because they did not meet the eligibility criteria. Most of them were excluded due to the methodological design they presented: almost none had a control group and/ or did not perform pre- and post-intervention comparisons centered on the families of children with hearing impairment. These data highlight the scarcity of studies on interventions with well-designed methodologies[21].

Nevertheless, all six intervention studies selected emphasized that the population with hearing impairment has limited opportunities for stimulation because the auditory input for linguistic development is degraded[32-37]. Thus, even if some technology is used to overcome this limitation, such as the Hearing Aids (HA), the Cochlear Implant (CI), or other auxiliary resources, the individual's auditory system lacks stimulus for its full development[1-4].

So, the family is an important agent in the process of stimulating the development of hearing and language in these children[5-16]. Family members are constantly in contact in the children's daily lives and therefore deserve to be highlighted in the intervention process. They can increase the quality of exposure to environmental stimuli in daily situations and thus better promote an auditory-linguistic prognosis, which is why it is important for them to be as well oriented as possible. Family-centered interventions should increasingly be encouraged in the context of child auditory rehabilitation, as evidence in the literature has already demonstrated[16-18].

In addition, intervention guided by video feedback is considered an advantage for childhood auditory rehabilitation. By using visual means to discuss interactions, it has positive effects on the interaction between the family and the child and on the self-esteem of the parents, benefiting the language development of the child with hearing impairment[10,11,32].

Thus, the importance of parents in the process of (re) enabling their children with hearing impairment, given their proximity and time with the child, especially in the early years, was highlighted by the selected articles[32-37].

Finally, the limitations found in this review were related to the small number of studies with quantitative information

**Table 1.** Descriptive summary of the characteristics of the included studies (n =6)

| Author | Study design | Experimental group | Control group | Age Group | Aims | Intervention model | Outcomes |
|---|---|---|---|---|---|---|---|
| Costa et al.[34] | Not randomized . | Children with hearing impairment (n = 6) | Children with hearing impairment (n = 6) | 2 years and 5 months to 5 years and 11 months | To evaluate the effectiveness of Parent-Child Interaction Therapy (PCIT) in behavioral intervention and language development in children with hearing impairment. | Parent-Child Interaction Therapy (PCIT). | Parents were involved in language stimulation. There was an improvement in the interactions between parent and child. The child's behavior and oral language skills, such as expressive vocabulary, were improved. |
| Glanemann et al.[35] | Not randomized | 15 parents of hearing impaired children | 14 parents of hearing impaired children | 3 months to 18 months | Evaluate the Muenster Parental Program (MPP). | Muenster Parental Program (MPP). Two individual counseling sessions, six group sessions and two individual training sessions with video feedback. | Trained parents improved their ability to respond to the child's vocal and pre-verbal cues and to respond to no-signs. In addition, parents reduced their inappropriate behavior and improved communication skills with their children. |
| Khoshakhlagh et al.[37] | Randomized | 15 hearing impaired children | 15 hearing impaired children | Age group below 5 years | To analyze the impact of early family-centered psychological and educational interventions on expressive and receptive language in children with hearing loss. | Group and individual counseling sessions with varied materials and focusing on teaching families about language development. | Early family-centered interventions would positively influence expressive and receptive language in children with hearing impairment, under the age of five. |
| Lam-Cassettari et al.[32] | Not randomized | 7 families of children with hearing impairment who received the intervention. | 7 families of hearing impaired children who participated in the waiting list before receiving the intervention | The children in Those who received the intervention had a mean age of 3 years and 4 months (SD: 2.6; range: 6 months - 6 years, 2 months) and those who did not receive the intervention had an average age of 1 year, 4 months (SD: 1.10; range: 9 months - 3 years, 2 months) | To examine the effect of videofeedback on parent-child communication in the context of childhood deafness. | Family-focused video intervention program. | Videofeedback, as an early intervention strategy, improves communication in families with prelingually hearing impaired children and encourages greater parent-child interaction. |

Between 6 and 24 months. To test the effects of a communication treatment implemented in parents, targeting prelinguistic communication skills in infants and children with hearing loss. Communication treatment implemented in parents, targeting prelinguistic communication skills in infants and children with hearing loss

Parents increased their use of supportive communication strategies. Children developed pre-linguistic and speech skills

**Table 1.** Continued...

| Author | Study design | Experimental group | Control group | Age Group | Aims | Intervention model | Outcomes |
|---|---|---|---|---|---|---|---|
| Nicastri et al.[36] | Not randomized | 22 parents (14 mothers and 8 fathers) of 14 children with profound hearing loss who received a Cochlear Implant at the Cochlear Implant Center of the Policlinico Umberto I-University Sapienza in Rome, Italy | 22 parents (14 mothers and 8 fathers) of 14 children with profound hearing loss who received a Cochlear Implant at the Cochlear Implant Center of the Policlinico Umberto I-University Sapienza in Rome, Italy | Children's chronological age: ± 2 months; hearing age: ± 2 months; pre-implant pure tone average from 250 to 4000 Hz and language level. Mean chronological age of mothers was 35.4 years (SD = 5.4) and of fathers 40.4 years (SD = 4.3). | To evaluate the effects of parental training in improving the communication development of children with profound hearing loss, users of Cochlear Implants. | Applied specific Parent Training (PT) programs, based on It Takes Two to Talk (ITTT), a program designed for children with language delays with the aim of empowering family-child interactions and making parents language facilitators for their children. sons. The ITTT was adapted to families of children with hearing impairment, being used to improve the parents' ability to respond to their children's communicative signals. For this, parents learned to apply specific strategies, such as observing, waiting and listening to the child's attempts to communicate before responding. Being considered as communicative acts, vocal and non-vocal signals, such as movements and actions, for the elaboration of joint attention with an emphasis on spoken language during interactions, in order to increase their linguistic skills. | The quality of family interaction and children's language increased significantly more in the Experimental group than in the control. This difference in communication between the study groups was present after 3 years. Parents seemed to benefit from the intervention (PT), which focused on strategies to enable and promote communicative skills in infants with Cochlear Implants. |
| Roberts[33] | Randomized | 9 children with hearing impairment | 10 hearing impaired children | Between 6 and 24 months | To test the effects of a communication treatment implemented in parents, targeting prelinguistic communication skills in infants and children with hearing loss. | Communication treatment implemented in parents, targeting prelinguistic communication skills in infants and children with hearing loss | Parents increased their use of supportive communication strategies. Children developed pre-linguistic and speech skills. |

Between 6 and 24 months. To test the effects of a communication treatment implemented in parents, targeting prelinguistic communication skills in infants and children with hearing loss. Communication treatment implemented in parents, targeting prelinguistic communication skills in infants and children with hearing loss
Parents increased their use of supportive communication strategies. Children developed pre-linguistic and speech skills

**Table 2.** Evidence Profile and Quality Assessment[30]

| Certainty assessment | | | | | | |
|---|---|---|---|---|---|---|
| **Participants(studies)follow-up** | **Risk of bias** | **Inconsistency** | **Indirect evidence** | **Imprecision** | **Publication bias** | **Overall certainty of evidence** |
| 0 (2 Randomized Clinical Trials) Child's language | serious a | serious b | not serious | serious c | none | ⊕◯◯◯ VERY LOW |
| 0 (2 Randomized Clinical Trials) Communication skills of parents or family | serious d | serious | not serious | serious c | none | ⊕◯◯◯ VERY LOW |
| 0 (4 Not randomized) Child's language | serious e | serious b | not serious | serious c | none | ⊕◯◯◯ VERY LOW |
| 0 (4 Not randomized) Communication skills of parents or family | serious e | serious f | not serious | serious c | none | ⊕◯◯◯ VERY LOW |

**Subtitle:** a. The. Allocation and randomization of studies; b. Several questionnaires were used to assess children's language; c. The sample number is less than 300 for the groups (Cochrane); d. Allocation and randomization of studies; e. Convenience sample, lack of randomization, confounding factors and no standardization of intervention time; f. There is no standardization of protocols to assess parents' communicative skills; CI: Confidence interval

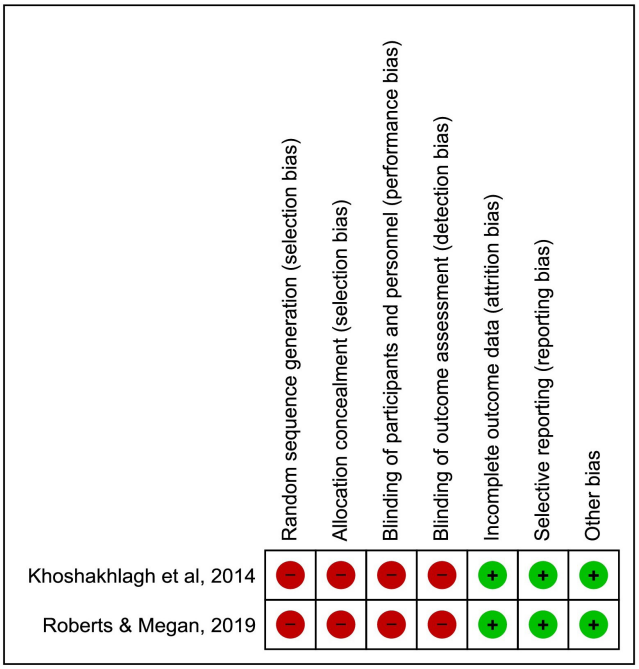



**Figure 2.** Summary risk of bias evaluation according to Cochrane's tool to assessed risk of bias in randomized controlled trials (RevMan 5.3, The Nordic Cochrane Centre, Copenhagen, Denmark) – randomized. **Subtitle:** Roberts[33] and Khoshakhlagh et al.[37]

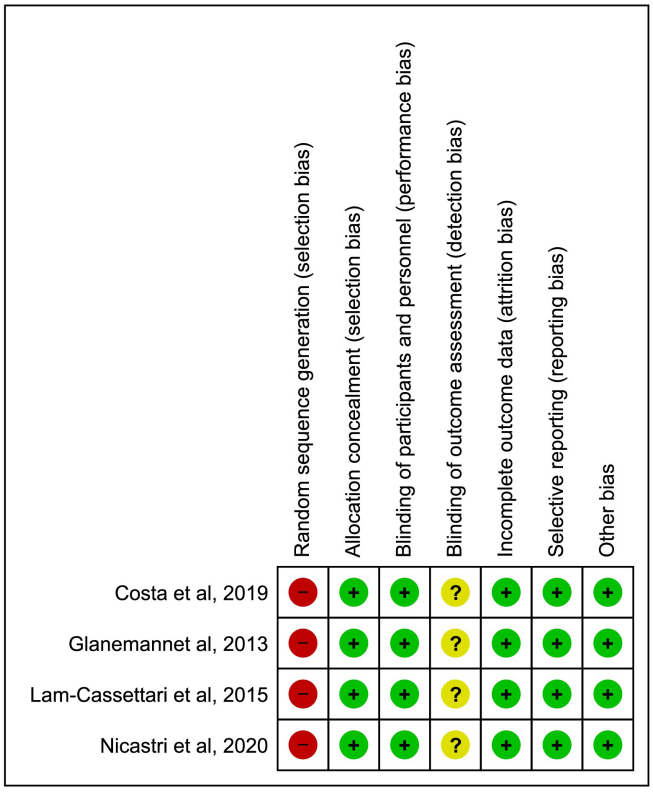



**Figure 3.** Summary risk of bias evaluation according to Cochrane's tool to assessed risk of bias in randomized controlled trials (RevMan 5.3, The Nordic Cochrane Centre, Copenhagen, Denmark) –not randomized. **Subtitle:** Costa et al.[34], Glanemann et al.[38], Lam-Cassettari et al.[32] and Nicastri et al.[36]

regarding measures and standardized protocols for pre- and post-family-centered intervention analysis, in order to demonstrate the impact of the family-centered strategy for auditory and language development in children with hearing impairment. In addition, due to the heterogeneity of the results of the studies analyzed, the effect size of the interventions was not evaluated. Therefore, new studies, with greater methodological rigor (randomized, double-blind) and detailed design are still needed to ensure recommendations based on scientific evidence to achieve an ideal intervention model focused on the family of children with hearing impairment. As well as, if possible, analyzing whether the results are consistent through the effect size following Cohen's d recommendations (d=0,2 was considered a small effect size, d=0,5 a medium effect size and d≥0,8 a large effect size)[39].

## CONCLUSION

It was concluded that the intervention centered on the family of children with hearing impairment generates positive effects on linguistic development. Therefore, this systematic review can

guide future research on this topic and encourage development of therapeutic programs tailored to the needs and singularities of children with hearing impairment and their families worldwide.

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**Appendix 1.** Search strategies used in the study databases

| Database | Research carried out July 30, 2019, and updated on June 06, 2024 |
|---|---|
| Cochrane | baby OR babies OR infant* OR toddler* OR child* OR pre-school* OR preschool* in Title Abstract Keyword AND "Parent education" OR "Family-centered" OR "Family-centered intervention" OR "Family-centered interventions" OR "Video Interaction Guidance" OR "Parent Child Interaction Therapy" OR "parental language input" OR "early intervention" OR "Auditory Verbal Intervention" in Title Abstract Keyword AND "hearing loss" OR "hypoacusis" OR "hypoacuses" OR "Hearing Impairment" OR "cochlear implants" OR "Cochlear Implant" OR "Cochlear Prosthesis" OR "Cochlear Prostheses" OR "Auditory Prosthesis" OR "Auditory Prostheses" in Title Abstract Keyword - (Word variations have been searched) |
| LILACS | ((tw:(child OR niño OR criança OR crianças)) AND (tw:("early intervention" OR "intervenciónprecoz" OR "intervençãoprecoce")) AND (tw:("hearing loss" OR "pérdidaauditiva" OR "perdaauditiva"))) |
| PsycINFO | Any Field: baby OR Any Field: Any Field: babies OR Any Field: Any Field: infant* OR Any Field: Any Field: toddler* OR Any Field: Any Field: child* OR Any Field: Any Field: pre-school* OR Any Field: Any Field: preschool* AND Any Field: "hearing loss" OR "hypoacusis" OR "hypoacuses" OR "Hearing Impairment" OR "cochlear implants" OR "Cochlear Implant" OR "Cochlear Prosthesis" OR "Cochlear Prostheses" OR "Auditory Prosthesis" OR "Auditory Prostheses" AND Any Field:: "Parent education" OR Any Field: Any Field: "Family-centered approach" OR Any Field: Any Field: "Family-centered intervention" OR Any Field: Any Field: "Family-centered interventions" OR Any Field: Any Field: "Video Interaction Guidance" OR Any Field: Any Field: "Parent Child Interaction Therapy" OR Any Field: Any Field: "parental language input" OR Any Field: Any Field: "early intervention" OR Any Field: Any Field: "Auditory Verbal |
| PubMed | ((((baby OR babies OR infant* OR toddler* OR child* OR pre-school* OR preschool*))) AND (("Parent education" OR "Family-centered approach" OR "Family-centered intervention" OR "Family-centered interventions" OR "Video Interaction Guidance" OR "VIG" OR "Parent Child Interaction Therapy" OR "PCIT" OR "parental language input" OR "early intervention" OR "Auditory Verbal Intervention"))) AND (("hearing loss"[MeSH Terms] OR "hypoacusis" OR "hypoacuses" OR "Hearing Impairment" OR "cochlear implants"[MeSH Terms] OR "Cochlear Implant" OR "Cochlear Prosthesis" OR "Cochlear Prostheses" OR "Auditory Prosthesis" OR "Auditory Prostheses")) |
| Scopus | TITLE-ABS-KEY (baby OR babies OR infant* OR toddler* OR child* OR pre-school* OR preschool* AND "hearing loss" OR hypoacusis OR hypoacuses OR "Hearing Impairment" OR "cochlear implants" OR "Cochlear Implant" OR "Cochlear Prosthesis" OR "Cochlear Prostheses" OR "Auditory Prosthesis" OR "Auditory Prostheses" AND "Parent education" OR "Family- centered approach" OR "Family-centered intervention" OR "Family-centered interventions" OR "Video Interaction Guidance" OR "Parent Child Interaction Therapy" OR "parental language input" OR "early intervention" OR "Auditory Verbal Intervention") |
| Web of Science | ((ALL=(baby OR babies OR infant OR toddler* OR child* OR pre-school* OR preschool*)) AND ALL=("hearing loss" OR "hypoacusia" OR "hypoacusia" OR "Hearing Impairment" OR "cochlear implants" OR "Cochlear Implant" OR "Cochlear Prosthesis" OR "Cochlear Prostheses" OR "Auditory Prosthesis" OR "Auditory Prostheses")) AND ALL=("Parent education" OR "Family-centered approach" OR "Family-centered intervention" OR "Family-centered interventions" OR "Video Interaction Guidance" OR "VIG" OR "Parent Child Interaction Therapy" OR "pcet" OR "parental language input" OR "early intervention" OR "Auditory Verbal Intervention") |
| EMBASE | #1 'baby'/exp OR baby OR babies OR infant* OR toddler* OR child* OR 'pre school*' OR preschool* #2 'hearing loss' OR hypoacusis OR hypoacuses OR 'hearing impairment' OR 'cochlear implants' OR 'cochlear implant' OR 'cochlear prosthesis' OR 'cochlear prostheses' OR 'auditory prosthesis' OR 'auditory prostheses' #3 'parent education' OR 'family- centered approach' OR 'family-centered intervention' OR 'family-centered interventions' OR 'video interaction guidance' OR 'parent child interaction therapy' OR 'parental language input' OR 'early intervention' OR 'auditory verbal intervention' #4 #1 AND #2 AND #3 #5 #4 AND [embase]/lim NOT ([embase]/lim AND [medline]/lim) |
| Gray literature | |
| Google Scholar | Infant AND "Parent education" OR "Family-centered approach" OR "Family-centered intervention" OR "Family-centered interventions" AND "hearing loss" filetype:pdf |

**Appendix 2.** Excluded articles and reasons for exclusion

| Author | Reasons for exclusion* |
|---|---|
| Brown and Remine[1] | 4 |
| Glanemann et al.[2] | 2 |
| Holzinger and Fellinger[3] | 5 |
| Kishida and Kemp[4] | 3 |
| Moeller et al.[5] | 3 |
| Reichmuth et al.[6] | 2 |

*__Caption:__ 1. Studies with adults and elderly people with hearing loss; 2.Studies that did not assess the approach with pre- and post-intervention measures; 3.Studies that did not have any comparison or control; 4.Studies that did not use a language assessment measure and/or a parent questionnaire about their children's language development; 5. Reviews, letters, books, conference abstracts, case reports, case series, opinion articles, technical articles and guidelines

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4 Kishida Y, Kemp C. Improving parents' interactions with children with hearing loss using data-based feedback. Int J Disabil Dev Educ. 2022;69(4):1216-34.

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6 Reichmuth K, Embacher A, Matulat P, Zehnhoff-Dinnesen A, Glanemann R. Responsive parenting intervention after identification of hearing loss by Universal Newborn Hearing Screening: The concept of the Muenster Parental Programme. Int J Pediatr Otorhinolaryngol. 2013;77(12):2030-9.

**Appendix 3.** Risk of Bias, randomized

| Domains[1] | Khoshakhlagh et al.[2] | Roberts[3] |
|---|---|---|
| 1. Performance bias | S | S |
| 2. Allocation concealment (selection bias) | S | S |
| 3. Random sequence generation (selection bias) | S | S |
| 4. Detection bias | S | S |
| 5. Attrition bias | L | L |
| 6. Reporting bias | L | L |
| 7.Other bias | L | L |
| % Risk of bias | 42,8% | 42,8% |
| | High | High |

Cochrane's tool to assessed risk of bias in randomized controlled trials
**Subtitle:** L = Low risk, U = Unclear Risk, S = Serious risk, NI = No info

## References

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2 Khoshakhlagh H, Behpajooh A, Afrooz G, Faramarzi S. The effect of early family-centered psychological and educational interventions on the cognition and social skills development in children with hearing loss. J Appl Environ Biol Sci. 2014;4(12):76-84.

3 Roberts MY. Parent-implemented communication treatment for infants and toddlers with hearing loss: a randomized pilot trial. J Speech Lang Hear Res. 2019;62(1):143-52. http://doi.org/10.1044/2018_JSLHR-L-18-0079.

**Appendix 4.** Risk of Bias, not randomized

| Domains[1] | Costa et al.[2] | Glanemann et al.[3] | Lam-Cassettari et al.[4] | Nicastri et al.[5] |
|---|---|---|---|---|
| 1. Bias due to confounding | S | S | S | S |
| 2. Bias in selection of participants into the study | L | L | L | L |
| 3. Bias in classification of interventions | L | L | L | L |
| 4. Bias due to deviations from intended interventions | U | U | U | U |
| 5. Bias due to missing data | L | L | L | L |
| 6. Bias in measurement of outcomes | L | L | L | L |
| 7. Bias in selection of the reported result | L | L | L | L |
| 8. Other bias | L | L | L | L |
| % Risk of bias | 75% Low | 75% Low | 75% Low | 75% Low |

**Subtitle:** L = Low risk, U = Unclear Risk, S = Serious risk, NI = No info

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3 Glanemann R, Reichmuth K, Zehnhoff-Dinnesen A. Münsteraner Elternprogramm – Elternfeedback. HNO. 2016;64(2):101-10. http://doi.org/10.1007/s00106-015-0096-4. PMid:26676519.

4 Lam-Cassettari C, Wadnerkar-Kamble MB, James DM. Enhancing parent-child communication and parental self-esteem with a video-feedback intervention: outcomes with prelingual deaf and hard-of-hearing children. J Deaf Stud Deaf Educ. 2015;20(3):266-74. http://doi.org/10.1093/deafed/env008. PMid:25819293.

5 Nicastri M, Giallini I, Ruoppolo G, Prosperini L, de Vincentiis M, Lauriello M, et al. Parent training and communication empowerment of children with Cochlear Implant. J Early Interv. 2020;43(2):117-34. http://doi.org/10.1177/1053815120922908.