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Systematic Review
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Influencing variables in the quality of life of children with cochlear implants: a systematic review

Variáveis influenciadoras na qualidade de vida de crianças com implante coclear: revisão sistemática

Keywords

Quality of Life
Child
Hearing Loss
Cochlear Implantation
Review

ABSTRACT

Purpose: To verify how the quality of life of children with cochlear implant was evaluated in published studies and to critically analyze which were the influencing variables. **Research Strategy:** Research guided by PRISMA recommendations. The guiding question was elaborated based on the PICO strategy, being: "Which variables are considered as influencers on the quality of life of children with cochlear implants?" The selected descriptors were cochlear implants, cochlear implants, quality of life, child and their synonyms, in the Portuguese, English and Spanish languages. We have identified indexed studies in the databases: Pubmed / MEDLINE, LILACS, Scopus, SciELO, Embase, EBSCO / CINAHL and Web of Science. **Selection Criteria:** Selected studies were selected, with levels of scientific evidence from 1 to 4, published in the Portuguese, English and Spanish languages, from 2009 to 2018. Data analysis: initially the titles of all the studies, followed by summaries and full reading of the most relevant texts. **Results:** After the rigorous analysis of the 1062 articles, eight were classified as containing the necessary answers to the guiding question of research. The selected studies were published between 2009 and 2016, classified as evidence level 2a and 4, with a sample of between 10 and 259 children and between the ages of 18 months and 18 years. **Conclusion:** The influencing factors that correlated with the quality of life of children with cochlear implants were early implantation, use of the electronic device, hearing skills and language skills.

Descritores

Qualidade de Vida
Criança
Perda Auditiva
Implante Coclear
Revisão

RESUMO

Objetivo: Verificar como a qualidade de vida de crianças com implante coclear foi avaliada em estudos publicados e analisar criticamente quais foram as variáveis influenciadoras. **Estratégia de Pesquisa:** Pesquisa norteada pelas recomendações do PRISMA. A pergunta norteadora foi elaborada com base na estratégia PICO, sendo: "Quais variáveis são consideradas como influenciadoras sobre a qualidade de vida de crianças com implante coclear?". Os descritores selecionados foram: implante coclear, implantes cocleares, qualidade de vida, criança e seus sinônimos, nos idiomas português, inglês e espanhol. Foram identificados estudos indexados nas bases de dados: Pubmed/MEDLINE, LILACS, Scopus, SciELO, Embase, EBSCO/CINAHL e Web of Science. **Critérios de Seleção:** Foram selecionados estudos direcionados ao tema, com níveis de evidência científica de 1 a 4, publicados nos idiomas português, inglês e espanhol, no período de 2009 a 2018. Análise dos dados: inicialmente analisou-se os títulos de todos os estudos encontrados, seguido dos resumos e da leitura na íntegra dos textos mais relevantes. **Resultados:** Após a análise rigorosa dos 1062 artigos, oito foram classificados como contendo as respostas necessárias à pergunta norteadora de pesquisa. Os estudos selecionados foram publicados entre os anos de 2009 a 2016, classificados em nível de evidência 2a e 4, com casuística entre dez a 259 crianças e com idades entre 18 meses a 18 anos incompletos. **Conclusão:** Os fatores influenciadores que se correlacionaram com a qualidade de vida das crianças com implante coclear foram: a implantação precoce, o uso do dispositivo eletrônico, as habilidades auditivas e as habilidades de linguagem.

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INTRODUCTION

Bilateral hearing losses of severe and / or profound degree occurring in childhood, especially in the pre-lingual phase, potentially restrict the communicative development with significant losses in the psychosocial, cognitive, emotional, academic areas, in addition to the quality of life of this population[1,2].

The cochlear implant (CI) is considered an important technological resource that is highly effective in rehabilitation children with pre-lingual hearing loss who do not have benefits with the use of the hearing aid (HA)[2-4]. However, surgery and CI adaptation alone do not guarantee the full benefit of its users. Several variables can interfere with the performance and quality of life of implanted children, such as: etiology, age at surgery and CI activation, time of auditory sensory deprivation, preoperative auditory residue, the number of electrodes inserted in the cochlea, the time of daily use of the device, insertion in specialized speech therapy based on the aurioral approach and family involvement in the therapeutic process[4-10].

This range of variability makes the implantation process complex, multidimensional and creates challenges in understanding the reasons why some children achieve better results in assessment, development, and quality of life tests when compared to the evolution of other children with the same criteria for the indication and adaptation of the CI[4,6,11,12].

In order to guarantee better development results in children with hearing loss, studies suggest that the therapeutic process with electronic devices should be started early, associated with appropriate measures of habilitation with specialized speech therapy, augmented with intense planning of family guidance and counseling. This premise accompanied by other variables can influence the development of auditory skills, the process of acquisition and development of spoken communication, in addition to the insertion and participation of children in different environments, with better results on self-confidence, autonomy, well-being, happiness, schooling processes, socialization and the quality of life of these children and their families[4,6,10,11,13-15].

PURPOSE

The present study aimed to conduct a systematic review based on verifying how the quality of life of children with cochlear implants was evaluated in published studies and critically analyzing what were the influencing variables.

RESEARCH STRATEGY

The present systematic review was conducted according to the criteria guided by the Cochrane Handbook[16] library, based on the PRISMA method (Preferred Reporting Items for Systematic Reviews and Meta-Analyzes)[17,18], which recommends the use of the following stage: (I) identification, (II) selection, (III) eligibility and (IV) inclusion.

The guiding question responsible for conducting search strategies aimed at studies with high scientific evidence was developed based on the research theme and was guided by the PICO strategy (Population, Intervention, Comparison, Outcome). Thus, the following question was established: What variables are considered to influence the quality of life of children with cochlear implants?

To search for the articles, the descriptors and synonyms listed in the indexing vocabulary of PubMed, Medical Subject Headings (MeSH terms) and in the library of Health Science Descriptors (DeCS) were selected, in the languages: Portuguese, English and Spanish (Chart 1).

Table 1 presents the advanced search strategies used in the search for articles, organized based on combinations of descriptors and synonyms using the "AND" bullet operator, and the number of studies identified (stage I) in the bibliographic survey in each one of the selected and accessed electronic databases: Pubmed / MEDLINE, LILACS, Scopus, SciELO, Embase, EBSCO / CINAHL and Web of Science.

SELECTION CRITERIA

The selection of studies (stage II) was conducted by two researchers, independently and blindly, following the following

Chart 1. Descriptors and synonyms chosen for the bibliographic search.

Portuguese		English		Spanish	
Descritores	Sinônimos	Descriptors	Synonyms	Descritores	Sinônimos
Implante Coclear	Implantação coclear	Cochlear implantation	Cochlear implantations	Implantación coclear	Implantación de prótesis coclear
	Implante de prótese coclear		Cochlear prosthesis		
Implantes cocleares	-	Cochlear implants	Cochlear implant	Implantes cocleares	-
			Cochlear prostheses		
Qualidade de vida	-	Quality of life	-	Calidad de vida	-
Criança	Crianças	Child	Children	Niño	-
				Niños	

Chart 2. Levels of scientific evidence according to the criteria proposed by ASHA.

Levels of evidence	Study types
1a	Systematic review or high-quality meta-analysis of randomized controlled trials
1b	High quality randomized controlled trials
2a	Systematic review or high-quality meta-analysis of non-randomized controlled trials
2b	High-quality, nonrandomized controlled trials
3a	Systematic review of cohort studies
3b	Individual cohort studies or low quality randomized controlled trials
4	Clinical outcome studies
5a	Systematic review of case control study
5b	Individual control case study
6	Case series
7	Expert opinion without explicit critical evaluation

Source: ASHA[19].

Table 1. Total articles selected from the search strategies and database chosen for bibliographic research.

Data base	Search strategy	Number of articles selected
Pubmed/MEDLINE	("cochlear implant" OR "cochlear implants" OR "cochlear prosthesis" OR "cochlear prostheses" OR "cochlear implantation" OR "cochlear implantations") AND ("quality of life") AND ("child" OR "children")	212
LILACS	("cochlear implant" OR "implante coclear" OR "implantación coclear" OR "cochlear implants" OR "implantes cocleares" OR "cochlear prosthesis" OR "implante de prótese coclear" OR "implantación de prótesis coclear" OR "cochlear prostheses" OR "cochlear implantation" OR "implantação coclear" OR "cochlear implantations") AND ("quality of life" OR "qualidade de vida" OR "calidad de vida") AND ("child" OR "criança" OR "niño" OR "children" OR "crianças" OR "niños")	4
Scopus	("cochlear implant" OR "cochlear implants" OR "cochlear prosthesis" OR "cochlear prostheses" OR "cochlear implantation" OR "cochlear implantations") AND ("quality of life") AND ("child" OR "children")	275
SciELO	subject: ("cochlear implants" OR "cochlear implantation") AND ("quality of life") AND ("child" OR "children")	6
Embase	("cochlear implant" OR "cochlear implants" OR "cochlear prosthesis" OR "cochlear prostheses" OR "cochlear implantation" OR "cochlear implantations") AND ("quality of life") AND ("child" OR "children")	263
EBSCO/CINAHL	("cochlear implant" OR "cochlear implants" OR "cochlear prosthesis" OR "cochlear prostheses" OR "cochlear implantation" OR "cochlear implantations") AND ("quality of life") AND ("child" OR "children")	77
Web of Science	("cochlear implant" OR "cochlear implants" OR "cochlear prosthesis" OR "cochlear prostheses" OR "cochlear implantation" OR "cochlear implantations") AND ("quality of life") AND ("child" OR "children")	225
Total	-	**1062**

inclusion criteria: 1) population: children with cochlear implant; 2) intervention: cochlear implant and auditory habilitation or rehabilitation by the aurioral method; 3) comparison: quality of life after using the cochlear implant; 4) results: variables of influence on the quality of life of children with cochlear implants; 5) time: publications made between the years 2009 to 2018; 6) language: Portuguese, English and Spanish; 7) types of studies: research with levels of scientific evidence 1a, 1b, 2a, 2b, 3a, 3b, and 4, proposed by the American Speech and Hearing Association (ASHA)[19] for the speech therapy course (Chart 2).

The following were excluded: 1) repeated studies; 2) book chapters; 3) studies with incomplete abstract or article; 4) studies that did not address the proposed theme; 5) studies with subjects over 18 years old; 6) studies carried out with children with Auditory Neuropathy Spectrum Disorder, hypoplasia of the auditory nerve, malformation of the external, middle or internal ear, unilateral deafness, children who are not oralized or with other impairments associated with hearing loss; 7) studies carried out with children not using a CI; 8) studies with children adapted only with simultaneous bilateral CI; 9) studies with the main objective of investigating quality of life and / or comparing groups (elderly, adults, users of other electronic devices, non-oral children, children with normal hearing), without the objective of investigating the influencing variables on the development of the group of children with CI; 10) studies with results acquired only from subjective impressions without objective data and standardized protocols.

DATA ANALYSIS

The data collected through the identification (I) and selection (II) stages were analyzed in the eligibility stage (III). Initially, the titles of all selected studies were investigated. Next, the abstracts of the remaining articles from the first stage were analyzed for the inclusion and exclusion criteria previously established. In the inclusion stage (IV), after studying the titles

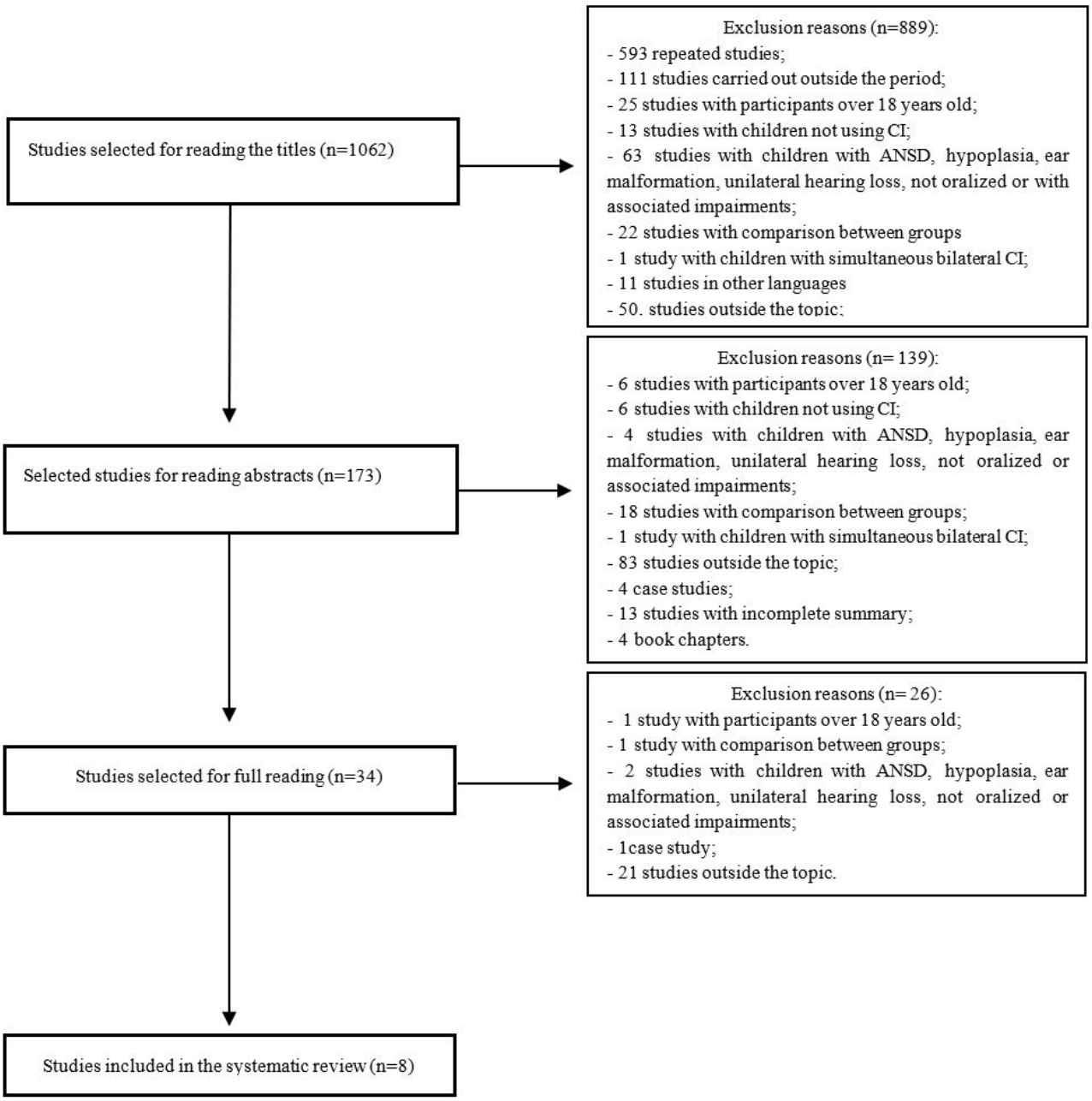

Figure 1. Selection of publications included in the systematic review.

and abstracts, the texts that left doubts about the eligibility criteria were read in full. Figure 1 represents the details of the selection process for publications included in the systematic literature review.

RESULTS

From the rigorous reading of the 34 studies chosen to read in full in the inclusion stage (IV), eight articles were classified as containing the necessary answers to the research question.

The details of the characteristics of the articles included in the systematic review of the literature in relation to the authors, title, level of scientific evidence, case series and age group, objectives, protocols used and variables evaluated, occurred through a standardized protocol sheet used in order to facilitate analyzing the data and retrieving the details relevant to the research (Table 2).

The eight selected articles were published between 2009 and 2016 and classified as evidence level 4, with the exception of the inclusion of a systematic review with evidence level 2a. In clinical research focused on the field of audiology, there are few studies that present the recommended designs for a systematic review (levels 1 and 2). The series of systematic reviews ranged from ten to 259 children, of both sexes, aged between 18 months and 18 years of age. With regard to methodological quality, all works used validated tools to study the quality of life of children with cochlear implants and the influencing variables.

Table 2. Protocol sheet with the characteristics of the studies included in the systematic review.

Authors	Title	Level of evidence	Casuistry and age group	Objectives	Protocols used	Variables evaluated
Liu, Liu, Kang, Gu, Hong[21]	Evaluation on health-related quality of life in deaf children with cochlear implant in China	Level 4	259 children aged 48 months to 11 years and their parents	To assess changes in the quality of life of children and adolescents with unilateral CI using the HUI3 and NCIQ	Quality of life questionnaires: HUI3, NCIQ; Auditory speech perception test: MSP™	Hearing skills
Noble, Hedley-Williams, Sunderhaus, Dawant, Labadie, Camarata, Gifford[22]	Initial results with image-guided cochlear implant programming in children	Level 4	18 children aged 5 to 17 years and their parents	Verify if image-guided CI programming can improve hearing results for children with CI	Quality of life questionnaire: PedsQL; Auditory speech perception test: LNT; CI programming: IGCIP	Hearing skills
Almeida, Matas, Couto, Carvalho[23]	Quality of life evaluation in children with cochlear implants	Level 4	15 children aged 2 to 12 years and their respective parents	Assess the quality of life of 15 children after CI activation and analyze the possible correlations between the different domains of quality of life, the time of CI use and the development of hearing skills	Quality of life questionnaire: CCIPP; Auditory speech perception test: GASP and Scale of Hearing Categories	Demographic factor (hearing age) and hearing skills
Kumar, Warner-Czyz, Silver, Betty, Tobey[24]	American parent perspectives on quality of life in pediatric cochlear implant recipients	Level 4	32 children aged 4 to 8 years and their parents	Assess the quality of life of children using CI and correlate with demographic variables	Quality of life questionnaire: CCIPP	Demographic factors (chronological age, age at activation and hearing age)
Morettin, Santos, Stefanini, Antonio, Bevilacqua, Cardoso[25]	Measures of quality of life in children with cochlear implant: systematic review	Level 2a	Studies carried out with samples of 28 to 222 children aged 2 to 16 years and their respective parents	To identify studies on quality of life in children using cochlear implants, to survey the main aspects evaluated in this population and the factors related to the measurement of quality of life	Quality of life questionnaires: CCIPP, KINDL, EQ-5D, CIF, specific questionnaire for assessing the CI constructed by the authors and VAS	Demographic factors (age at surgery, chronological age, and hearing age), hearing skills and language skills
Fortunato-Tavares, Befi-Lopes, Bento, Andrade[26]	Children with cochlear implants: communication skills and quality of life	Level 4	10 children aged 4 to 8 years and their parents	Translation and adaptation of an international questionnaire into Brazilian Portuguese; analysis of correlations between factors related to quality of life; analysis of the correlations between quality of life and clinical outcome measures	Quality of life questionnaire: CCIPP; Language questionnaires LAVE, MUSS; Auditory speech perception tests: MAIS, IT-MAIS	Auditory and language skills

Legend - CI= Cochlear implant; AASI= Hearing aid; HUI3= Health Utilities Index Mark 3; NCIQ= Nijmegen Cochlear Implant Questionnaire; MSP™= Mandarin Speech Perception test materials; PedsQL= Pediatric Quality of Life Inventory or; LNT= Lexical Neighborhood Test; IGCIP= Image-Guided Cochlear Implant Programming; CCIPP= Children with Cochlear Implants: Parental Perspectives; GASP= Glendonald Auditory Screening Perception; KINDL= Questionnaire Measuring Health-Related Quality of Life in Children and Adolescents; EQ-5D: Euro Quality of Life Instrument – 5D; CIF= International Classification of Functionality, Disability and Health; VAS= Visual Analogue Scale; LAVE= Expressive Vocabulary Assessment List; MAIS= Meaningful Auditory Integration Scale; IT-MAIS= The Infant-Toddler Meaningful Auditory Integration Scale; MUSS= Meaningful Use of Speech Scale; SSQ= Speech, Spatial and Qualities of Hearing Scale for Parents; MLNT= Multisyllabic, Lexical Neighborhood Test; The QoL- C= The children's quality of life questionnaire.

Table 2. Continued...

Authors	Title	Level of evidence	Casuistry and age group	Objectives	Protocols used	Variables evaluated
Lovett, Kitterick, Hewitt, Summerfield[27]	Bilateral or unilateral cochlear implantation for deaf children: an observational study	Level 4	106 children aged 18 months to 16 years and their parents	Assess whether bilateral implantation is associated with better listening skills and higher quality of life when compared to unilateral implantation	Quality of life questionnaires: HUI3, VAS; Auditory speech perception tests: Auditory location in silence and noise; SSQ	Hearing skills
Schorr, Roth, Fox[28]	Quality of Life for children with cochlear implants: perceived benefits and problems and the perception of single words and emotional sounds	Level 4	37 children aged 5 to 14 years	Examine the subjective perceptions of children about the quality of life with the use of CI, to investigate the ability to perceive vocal emotion and the influence of auditory functioning and age in CI surgery on quality of life	Quality of life questionnaire: The Q*o*L-C; Auditory speech perception tests: LNT, MLNT, Vocal emotion identification	Demographic factors (gender, socioeconomic status, chronological age, age at hearing aid fitting, age at CI activation and hearing age), hearing skills and language skills

Legend - CI= Cochlear implant; AASI= Hearing aid; HUI3= Health Utilities Index Mark 3; NCIQ= Nijmegen Cochlear Implant Questionnaire; MSP™= Mandarin Speech Perception test materials; PedsQL= Pediatric Quality of Life Inventory or; LNT= Lexical Neighborhood Test; IGCIP= Image-Guided Cochlear Implant Programming; CCIPP= Children with Cochlear Implants: Parental Perspectives; GASP= Glendonald Auditory Screening Perception; KINDL= Questionnaire Measuring Health-Related Quality of Life in Children and Adolescents; EQ-5D: Euro Quality of Life Instrument – 5D; CIF= International Classification of Functionality, Disability and Health; VAS= Visual Analogue Scale; LAVE= Expressive Vocabulary Assessment List; MAIS= Meaningful Auditory Integration Scale; IT-MAIS= The Infant-Toddler Meaningful Auditory Integration Scale; MUSS= Meaningful Use of Speech Scale; SSQ= Speech, Spatial and Qualities of Hearing Scale for Parents; MLNT= Multisyllabic, Lexical Neighborhood Test; The QoL- C= The children's quality of life questionnaire.

According to the World Health Organization (WHO)[20], quality of life concerns "the individual's perception of his insertion in life in the context of the culture and value systems in which he lives and in relation to his goals, expectations, standards and concerns". This definition indicates the complex relationship between the multifactorial aspects that involve physical, mental, psychological, emotional and spiritual well-being, social, family and affective relationships, health, school and education, housing, past experiences, current and future of individuals in the face of cultural contexts and ethical and moral values, and other circumstances of life[15].

In children with cochlear implants, in addition to the dimensions discussed above, the study of quality of life also encompasses a range of aspects related to self-esteem, self-image, and self-confidence built upon the diagnosis of hearing impairment, satisfaction with the use of a CI, independence, self-sufficiency, self-care, mobility, pain, the use of cell phones and hearing aid devices, preferences, auditory perception and understanding of speech, communication, and also, the attitude of others towards all these factors[25,26]. In the present systematic review, we note the investigation of aspects of the physical, psychological, emotional and social quality of life of children with cochlear implants, preferentially influenced by demographic variables, auditory skills and language skills.

Demographic variables influencing quality of life were identified in four studies[23-25,28]. In the analysis between sex, socioeconomic level, chronological age, age at hearing aid adaptation, age at CI activation, hearing age (time of using electronic devices), and quality of life performed in the first study[27], the variable age at the use of the first amplification (hearing aid) revealed a statistically significant negative correlation with quality of life, reinforcing that the lower the age at the hearing aid adaptation, the greater the quality of life. Taking into account that, the children who received the hearing aid earlier also had the longest time of use of the device, the highest hearing ages correlated in a statistically significant positive way with the highest studied quality of life indexes.

Considering that in Brazil the possibility of newborn hearing screening (NHS) and early diagnosis of hearing loss are ensured by Law No. 12,303 / 2010[29] and Ordinance No. 587/2004[30] that institutes the National Policy for Hearing Health Care, this result reinforces the importance of the NHS programs to be solidly articulated with the intervention programs and speech therapy that precede cochlear implant surgery, which will allow these children to use the amplification early and continuously, culminating in a better quality of life over time.

The early intervention with a positive impact on quality of life was also demonstrated in a systematic review study[25] in which the results of the selected articles demonstrated that children who underwent CI surgery at an earlier age had statistically significant negative correlations with quality of life. Children with older hearing age and older chronological age obtained statistically significant positive correlations related to quality of life.

On the other hand, studies carried out comparative analyzes between demographic factors: age at activation, chronological age, hearing age and quality of life[24]; and the auditory age and quality of life of children with a CI[23], and found no statistically significant correlations. However, in the last study[23] when comparing the groups organized according to the hearing age (G1: children with hearing age greater than 24 months, and G2: children with hearing age less than 24 months), the statistically significant difference between the groups confirmed the positive interference of time and daily use of CI on the specific domain of communication in the investigation of the assessment of quality of life in the group of children with older hearing age.

Of the eight studies selected, the auditory skills variable was examined and compared with the quality of life in seven studies[21-23,25-28]. It is natural that this variable is widely studied in view of the fact that the development of auditory skills is pointed out in the specialized literature as the main prerequisite for the acquisition of spoken language[3], which in turn impacts on quality of life[23,24,26]. The studies investigated in a systematic literature review[25] revealed that the early development of hearing skills has statistically significant relationships with quality of life assessments. In the same vein, researchers[26] assessed the development of the hearing skills of children with a CI and verified the presence of a statistically significant correlation with the communication domain in the assessment of quality of life.

Other evidence[27] points to the influence of hearing skills on quality of life after using a CI, without statistically significant differences between the groups of children using unilateral a CI and users of sequential bilateral CI. However, it reveals statistically significant better results for the adapted group with bilateral CI in tests of discrimination, location, movement tracking and speech perception in noise when compared to the group with the unilateral CI.

The researchers' attention also turned to a refined analysis of hearing skills after using an image-guided cochlear implant programming technique, called Image-Guided Cochlear Implant Programming – IGCIP[22]. Such strategy aims at the detailed analysis of the Computed Tomography images of patients with a CI in order to estimate the exact position of the electrodes in the cochlea in relation to the auditory nerve to identify the electrodes with high levels of overlap and stimulation, and to disable them when required. This technique allows the creation of more personalized CI maps, promotes the improvement of stimulation and, consequently, the auditory perception of speech. The results of the study[22] showed a statistically significant increase in the quality of life of children with a CI due to the improvement in the auditory perception of speech through the use of the referred programming technique. Although it is a technology not used in all cochlear implant centers, such results are encouraging to enable technological advances in the routines for monitoring implanted children, whether in the public or private system.

Considering that the results of the cochlear implant in children are multidimensional and multifactorial, some variables can be strongly manifested in the quality of life of some children, and not in others. An example of this was observed in studies[21,23,28] in which no statistically significant correlations were found between auditory speech perception and quality of life. Even so, in one of the aforementioned studies[28] when investigating the specific ability to perceive vocal emotion in non-linguistic sounds, a statistically significant correlation was observed with the highest quality of life scores.

Spoken language is also pointed out in the specialized literature as one of the possible variables that impact the quality of life of children with cochlear implants. In the present systematic review, the correlation between spoken language skills and the quality of life of children with a CI was described by three studies[25,26,28]. The first authors[26] examined the development of lexical and speech skills and found statistically significant correlations between these skills and the domains of quality of life. The studies identified in a systematic review[25] agreed with these findings and pointed out that the early development of language and communication skills correlates in a statistically significant way with quality of life. On the other hand, researchers[28] who investigated verbal cognitive performance and language skills found no statistically significant correlations with quality of life.

There is diversity in the literature regarding the variables that influence and predict the quality of life of children with a CI. In the present study, the heterogeneity of ages in CI surgery, the auditory ages and the chronological ages of the evaluated population, as well as the use of different instruments for investigating hearing, language and quality of life skills, may justify the limitation in the consensus between the results obtained.

Another possible justification may be related to the fact that, in the pediatric and child population, assessments of quality of life commonly occur through the parents' view, either due to the scarcity of standardized, specific and sensitive instruments to the children's perception, or due to the difficulty of capturing precise answers in this audience. In the present study, six[21-24,26,27] of the identified articles assessed children's quality of life from the parents' perspective, and only two[25,28] took into account the children's self-perception. Considering the scope and subjectivity of the concept of quality of life, it is natural that, in some cases, parents' perceptions when compared to those of CI users themselves, present divergences. Despite the scarce results in the literature, it is believed that, when compared and / or combined with parents' perceptions, children's views on their own quality of life may contribute to the expansion of the quality of life research scenario and its influencing variables.

Taking into account the complexity in which the therapeutic process aimed at children with cochlear implant involves, the fact that there is no consensus among the selected studies does not minimize the value of the results, which demonstrated the impact of objective clinical measures on subjective development and the quality of life of children with cochlear implants since the clinical variables analyzed related to early implantation, the use of the electronic device, the best hearing and language skills correlated with the increase in the quality of life of this population. It is understood that the complexity of the CI indication, implantation and follow-up process hinders the expected balance between the clinical variables and quality of life. Furthermore, despite the positive results described in the literature, it is not possible to say that the control of these factors will guarantee the

best auditory, language and quality of life results. Finally, it is noteworthy that no studies were found to investigate the correlation between the quality of life of children with a CI and the variables: family permeability, parental education, and socioeconomic aspects, factors that deserve attention and justify the performance of new research in the area.

CONCLUSION

The influencing factors that correlated with the quality of life of children with cochlear implants in the selected studies were early implantation, the use of the electronic device, auditory skills and language skills.

The present systematic review adds to the previously published bibliographic findings on the topic, identifies additional texts and suggests the relevance of further research in the area. It is hoped that the present study will help to understand the importance of investing in the influencing variables in the development and quality of life of children with a CI, resulting in practical investments in the pre and post- surgical clinical speech therapy routine of these children.

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Author contributions

JMS is the main author of the work and carried out the design of the study project, acquisition, analysis and interpretation of data, preparation of the article, correction, critical review for relevant intellectual content and final approval of the version to be presented for publication. ALMM was the advisor responsible for guiding the stages of project design, acquisition, analysis and interpretation of data, correction of the critical review article for relevant intellectual content and final approval of the version to be presented for publication. PDC assisted in the conception of the study project, preparation of the article, correction, critical review for relevant intellectual content and final approval of the version to be presented for publication.