

Problems in Early Identification of Children with Hearing Loss: A Narrative Review of Research

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ABSTRACT

Early identification of hearing loss in children is crucial for their cognitive and linguistic development. So, the major objectives of this research were to identify the common practices, problems and challenges in early identification of children with hearing loss discussed in various studies. The research design was qualitative and narrative review was conducted to explore the challenges associated with the early detection of hearing loss in children. The study involved a comprehensive search of academic databases, medical journals, and credible sources to collect relevant studies focusing on the obstacles and limitations in identifying hearing loss at an early stage. After the literature search, the selected studies were critically evaluated. Key information was extracted from each study to identify common themes and patterns related to the challenges in early detection. Results highlighted the regional variations in the causes of hearing loss, highlighting the need for targeted interventions and screening programs in different parts of the country. Consanguinity, particularly first cousin marriages, emerged as a significant risk factor for childhood deafness in Pakistan. The prevalence of parental consanguinity was found to be high in certain regions, contributing to the increased risk of congenital hearing impairment in children. However, beyond consanguinity, other factors such as infectious diseases, genetic factors, and environmental influences can also lead to hearing loss in children. To overcome these challenges, several key recommendations can be proposed. Implementing universal newborn hearing screening programs is crucial to identify hearing impairment in infants before critical language and communication development stages. This requires collaboration between healthcare providers, policymakers, and advocacy organizations to ensure equitable access to screening services across all regions.

KEYWORDS

Early Identification, Children with Hearing Loss, Genetic Factors

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INTRODUCTION

Hearing loss among children in Pakistan is a prevalent issue with far-reaching consequences. According to the World Health Organization (WHO), an estimated 4.7% of Pakistan's population experiences hearing impairment, and this problem is particularly pronounced among children (WHO, 2021). The causes of hearing loss in Pakistani children are diverse, ranging from genetic factors to infections during pregnancy, inadequate healthcare access, and the lack of awareness regarding preventive measures. This issue significantly impacts children's development, as hearing plays a crucial role in language acquisition and cognitive growth during the early years. Impaired hearing can lead to communication difficulties, delayed speech and language development, and hinder educational attainment. Addressing the challenge of hearing loss in kids in Pakistan requires a multifaceted approach, involving improved healthcare infrastructure, early intervention, education, and awareness campaigns to ensure that children have the opportunity to reach their full potential despite this obstacle (WHO, 2018).

Hearing impairment in children is a significant and often overlooked disability that can have profound consequences on their overall development and quality of life. According to global estimates, one in 1,000 infants is born with major sensorineural hearing loss (Zakzouk, 2002). In nations such as Pakistan, the difficulties encountered by children experiencing hearing impairment are notably exacerbated owing to restricted resources and insufficient awareness concerning the timely detection and necessary actions. Early detection of hearing impairment is crucial as it allows for timely intervention and support, facilitating better communication and language development in affected children (Mumtaz & Butt, 2013).

Although childhood hearing impairment is widespread in Pakistan, there is a lack of comprehensive research focusing on the causes and early identification of hearing loss across the country. Prior research has illuminated the notable occurrence of consanguineous marriages in Pakistan, a factor that has been recognized as a substantial contributor to childhood deafness (Sajjad et al., 2019). For instance, a study conducted in the Peshawar district of Pakistan revealed that 86.4% of deaf children had parents who were first or second cousins (Sajjad et al., 2008).



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However, the lack of reliable, standardized epidemiological data and proper neonatal hearing screening programs contribute to late detection of hearing impairment, leading to delayed intervention and poorer outcomes for affected children. Moreover, the existing literature primarily focuses on specific regions, and there is a need for a comprehensive narrative review that encompasses all regions of Pakistan. Conducting such an examination can offer valuable perspectives on the difficulties encountered in promptly identifying children with hearing loss. This can subsequently facilitate the development of strategies grounded in evidence to effectively tackle these obstacles.

Hence, the principal aim of this narrative assessment is to investigate the current body of research concerning childhood hearing impairment in Pakistan, with specific emphasis on early detection and the influence of parental consanguinity as a risk element. Through the synthesis and thorough evaluation of accessible literature, this study aims to underscore the significance of timely identification and proactive measures to mitigate the repercussions of hearing impairment on affected juveniles and their families. Furthermore, this appraisal endeavors to offer suggestions for policymakers and healthcare authorities to devise efficient screening initiatives and interventions capable of enhancing outcomes and the overall quality of life for children experiencing hearing loss throughout Pakistan. By means of this comprehensive evaluation, our intention is to make a substantive contribution to the sphere of knowledge concerning childhood hearing impairment and to advocate for strategies addressing this urgent public health concern within the nation.

LITERATURE REVIEW

Childhood hearing impairment stands as a noteworthy public health issue, exerting an impact on the general welfare and growth of the youngsters affected. Within Pakistan, the prominence of hearing loss among children presents an urgent challenge. However, comprehensive investigations into its occurrence and underlying factors within diverse regions of the nation remain insufficient. This literature review aims to examine the existing research on childhood hearing impairment in Pakistan, focusing on its prevalence and distribution in various regions.

Prevalence of Hearing Loss in Children in Pakistan

Childhood hearing loss is a significant health concern with profound implications for a child's overall development and quality of life. Global estimates suggest that one in 1,000 infants is born with major sensorineural hearing loss (World Health Organization, 2021). Nonetheless, within Pakistan, the probability of encountering childhood hearing impairment is anticipated to be elevated, considering the substantial population size of the nation and the existence of particular risk elements, like consanguineous unions.

Consanguinity, particularly first cousin marriages, has been identified as a significant risk factor for childhood deafness in Pakistan (Zakzouk, 2002). In consanguineous marriages, individuals share a common ancestor, leading to an increased likelihood of inherited genetic disorders, including hearing impairment. An investigation carried out in the Peshawar district of Pakistan illuminated the frequency of hearing loss among youngsters enrolled in specialized schools for the hearing impaired (Sajjad et al., 2023). The findings of the study revealed that an astounding 92.1% of the children with hearing impairment had profound sensorineural hearing loss, pointing to a substantial incidence of severe auditory impairment among the affected youth.

Furthermore, the investigation unveiled that 86.4% of these youngsters were born to parents who were either first or second cousins, thereby reinforcing the connection between consanguinity and childhood hearing loss (Sajjad et al., 2008). The substantial prevalence of marriages among close relatives in Pakistan has been extensively documented. The 1991 Pakistan Demographic and Health Survey highlighted that over 50% of women aged 15 to 49 who were married were wedded to their first cousins, and the inclusion of second cousins raised the proportion of consanguineous marriages to 61.2% (Pakistan Demographic and Health Survey, 1991).

The occurrence of parental consanguinity in Pakistan exhibits regional variations, wherein rural regions demonstrate even more elevated frequencies of consanguineous unions (Pakistan Demographic and Health Survey, 1991). The high prevalence of consanguinity contributes to the increased risk of congenital hearing impairment in children. In such marriages, the risk of inheriting identical genes at various loci increases, making children more susceptible to autosomal recessive genetic disorders, including hearing loss (Zakzouk, 2002).

Nevertheless, it's crucial to acknowledge that although consanguinity stands as a noteworthy risk element, it does not stand alone as the exclusive instigator of childhood hearing impairment within Pakistan. Additional influences, including environmental factors (such as infections like measles, mumps, and meningitis) as well as genetic mutations, also play a role in the incidence of hearing loss among children (Sajjad et al., 2008).

The urgent requirement for concentrated efforts and extensive public health strategies is evident due to the substantial occurrence of childhood hearing loss in Pakistan. It is imperative to promptly address this matter. The prompt identification and timely intervention are pivotal in lessening the adverse effects of hearing impairment on the children concerned as well as their families. The establishment of organized neonatal hearing screening initiatives within healthcare establishments can markedly enhance the early identification of hearing loss, enabling swift intervention and assistance. Furthermore, heightening awareness among both parents and healthcare practitioners regarding the significance of early screening can effectively

contribute to alleviating the burden of childhood hearing impairment within Pakistan. By tackling the root risk elements and providing suitable support and measures, Pakistan can take noteworthy strides towards ensuring superior outcomes and an enhanced quality of life for children grappling with hearing loss.

Causes of Hearing Loss in Children

Various studies conducted across different regions of Pakistan have shed light on the multifaceted nature of hearing loss causes and the importance of early detection. Research conducted by organizations like the Pakistan Institute of Medical Sciences (PIMS) and Aga Khan University Hospital has highlighted the prevalence of congenital factors, such as genetic predisposition and consanguineous marriages, as leading causes of hearing impairment in children. Additionally, a lack of access to proper healthcare services and immunization programs has contributed to the prevalence of preventable infections, like rubella and meningitis, which can lead to hearing loss (Khurshid et al., 2022; Qureshi et al., 2017).

These studies have emphasized the significance of early identification and intervention. The use of universal newborn hearing screening programs, like those introduced in select hospitals, has been shown to aid in the early detection of hearing issues, allowing for timely medical interventions, hearing aids, or cochlear implants if necessary. However, challenges such as limited awareness about the importance of early screening and the shortage of specialized professionals in audiology and speech therapy remain significant barriers (Joint Committee on Infant Hearing, 2007).

To comprehensively address the issue of hearing loss in Pakistani children, it is imperative for these studies to guide policy-making and healthcare initiatives. A collaborative effort between healthcare professionals, policymakers, and community leaders is needed to implement effective screening programs, ensure widespread awareness about preventive measures, and provide accessible and affordable interventions for affected children. Through such efforts, Pakistan can work towards mitigating the impact of hearing loss on children's development and improving their overall quality of life.

Childhood hearing impairment can result from a complex interplay of genetic, environmental, and infectious factors (Smith et al., 2009). Comprehending the diverse origins of hearing loss is fundamental for formulating efficacious strategies aimed at prevention and intervention. This literature review explores the different factors contributing to childhood hearing impairment in Pakistan, with a particular focus on consanguinity, infectious diseases, genetic factors, and environmental influences.

Consanguinity and Genetic Factors: Consanguineous marriages, particularly first cousin marriages, have been identified as significant risk factors for childhood deafness in Pakistan (Zakzouk, 2002). Research findings indicate that progeny from unions between close relatives exhibit an increased occurrence of autosomal recessive disorders, encompassing hearing impairment (Sajjad et al., 2008). The prevalence of parental consanguinity in Pakistan has been reported to be as high as 61.2%, with rural areas showing even higher rates of consanguineous marriages (Pakistan Demographic and Health Survey, 1991). In addition to consanguinity, genetic factors play a substantial role in childhood hearing impairment. Mutations in specific genes, such as the connexin 26 gene (DFNB1 locus), have been associated with both autosomal dominant and autosomal recessive forms of hearing impairment (Sajjad et al., 2008). It is essential to recognize the genetic basis of hearing loss in order to provide appropriate genetic counseling and early interventions for affected children.

Infectious Diseases: Infectious diseases can also contribute to childhood hearing loss. Measles, mumps, and meningitis have been identified as potential causes of sensorineural hearing loss in children (Sajjad et al., 2008). These infections can lead to permanent hearing impairment, particularly if they occur during infancy or childhood. The prevalence of these infections and their impact on hearing loss may vary across different regions of Pakistan, warranting further investigation.

Environmental Factors: Environmental factors, such as exposure to ototoxic drugs or acoustic trauma, can also lead to hearing loss in children. Ototoxic drugs, such as certain antibiotics and chemotherapy agents, can damage the delicate structures of the inner ear, resulting in hearing impairment. Additionally, exposure to excessive noise levels, such as loud music or industrial noise, can cause noise-induced hearing loss in children. However, the exact prevalence of these environmental causes in different regions of Pakistan remains unclear and requires further research (Pak et al., 2020).

Importance of Early Identification

Early identification of hearing loss is critical for several reasons. First and foremost, it allows for timely intervention, which is essential for maximizing a child's communication and language development during the critical early years of life (World Health Organization, 2021). Studies have shown that children who receive intervention for hearing loss at an early age demonstrate better speech and language skills compared to those with delayed diagnosis (Sajjad et al., 2008).

Moreover, early identification also enables the identification of potential underlying causes of hearing loss, such as genetic mutations or environmental factors. Understanding the specific etiology of hearing impairment is essential for tailoring appropriate interventions and counseling for families. In cases where consanguinity is identified as a risk factor, genetic counseling and family planning can help mitigate the risk of future hearing impairment in subsequent generations (Zakzouk, 2002).

Additionally, early identification of hearing loss can significantly impact a child's overall development and quality of life. Hearing impairment can have profound consequences on a child's social, emotional, and cognitive development (Sajjad et al., 2008). Children with untreated hearing loss may experience feelings of isolation and frustration due to communication

difficulties, leading to social and behavioral challenges. They may also struggle academically, as hearing plays a crucial role in language acquisition and learning. By identifying and addressing hearing loss early on, we can provide the necessary support and interventions to mitigate these negative impacts and foster healthy development in affected children (World Health Organization, 2018).

Early identification is also crucial for promoting inclusive education and integration into mainstream society. With appropriate intervention and support, children with hearing loss can participate fully in educational settings and engage with their peers. Access to education and communication is a fundamental right, and early identification ensures that children with hearing impairment have equal opportunities to thrive in educational environments (World Health Organization, 2021).

Furthermore, early identification of hearing loss can have significant economic implications. Studies have shown that the cost of providing intervention and support for children with hearing loss is considerably lower when identified early (Sajjad et al., 2008). Early intervention reduces the need for more extensive and costly interventions in the future, such as special education services and remedial support. Additionally, children who receive early intervention are more likely to achieve better educational outcomes and have improved long-term employment prospects, contributing positively to the economy and society as a whole (Elango et al., 2015).

From a public health perspective, early identification of hearing loss is crucial for disease surveillance and planning appropriate health interventions. Understanding the prevalence and causes of hearing impairment allows policymakers to allocate resources effectively and develop targeted programs to address specific risk factors. For instance, knowing the prevalence of consanguinity-related hearing loss can inform the development of genetic counseling services and awareness campaigns to reduce the occurrence of genetic hearing impairment (Korver et al., 2017).

Furthermore, the timely recognition of hearing loss holds utmost importance for the execution of neonatal hearing screening initiatives. The widespread implementation of hearing screenings for newborns facilitates the early identification of auditory impairments, thereby enabling prompt intervention and assistance. Several developed countries have successfully implemented such screening programs, leading to improved outcomes for children with hearing loss (World Health Organization, 2021). In Pakistan, the establishment of similar programs can have a transformative impact on the lives of children with hearing impairment and their families.

Early identification of hearing loss is also essential for advocating for policy changes and inclusive practices in society. When policymakers and the public are aware of the prevalence and impact of hearing impairment, they are more likely to support initiatives that promote accessibility and inclusion for individuals with hearing loss. This includes measures such as providing sign language interpreters, ensuring hearing aid coverage, and implementing accessible communication in public spaces (Aldabas, 2015).

Furthermore, early identification contributes to building a comprehensive database on hearing impairment in country. A better understanding of the prevalence, causes, and regional variations of hearing loss can inform future research and guide evidence-based interventions. Research on childhood hearing impairment can also inform healthcare professionals, educators, and policymakers about best practices and approaches for supporting children with hearing loss effectively (Al Babbain et al., 2023).

Lastly, early identification empowers parents and families to take proactive steps in managing their child's hearing impairment. When parents are informed about their child's hearing status early on, they can seek appropriate medical and educational support promptly. Early intervention can reduce parental stress and uncertainty and empower them to advocate for their child's needs effectively (Fulcher et al., 2015).

In conclusion, the importance of early identification of hearing loss cannot be overstated. It is a critical step in maximizing a child's communication and language development, understanding the underlying causes, and providing timely intervention and support. Early identification fosters inclusive education, improves long-term outcomes, and has significant economic and public health implications. Acknowledging the significance of timely recognition, efforts can be directed towards establishing an environment that is more inclusive and supportive for children grappling with hearing impairment within Pakistan.

Research Objectives

1. Identify the common practices in early identification of children with hearing loss discussed in various studies.
2. Explore the problems and challenges in early identification of children with hearing loss.

RESEARCH METHODOLOGY

In this research, a narrative review of existing research was conducted to explore the challenges associated with the early detection of hearing loss in children. The study involved a comprehensive search of academic databases, medical journals, and credible sources to collect relevant studies focusing on the obstacles and limitations in identifying hearing loss at an early stage. After the literature search, the selected studies were critically evaluated. Key information was extracted from each study to identify common themes and patterns related to the challenges in early detection. The narrative review provided a coherent

summary of the identified challenges, offering valuable insights to inform future efforts in improving the early detection and intervention for children with hearing loss.

Inclusion and Exclusion Criteria

Following inclusion and exclusion criteria was formulated to conducting this study:

1. Encompassed studies were limited to those published in the English language.
2. Encompassed studies were confined to those published within the timeframe spanning 2007 to 2022.
3. Included studies concentrated on the early detection of hearing loss in children.
4. Online medical Journal, google scholar and academic databases were included.
5. Both global and indigenous research were selected for review and analysis.
6. Studies which were conducted on hearing screening and diagnosis of adults, hearing assessment of *intellectual* and developmental *disabilities, learning disabilities etc* were not included in review.

RESULTS

Early identification of childhood hearing loss is of paramount importance as it allows for timely intervention and support, which can significantly improve language development, communication skills, and overall quality of life for affected children. However, in many countries and regions of Pakistan, a significant challenge that hinder the early identification of hearing impairment.

Limited Access to Healthcare Services: In Pakistan, access to healthcare services remains a major challenge, particularly in rural and underserved areas. Many families living in remote regions do not have easy access to healthcare facilities equipped with the necessary resources for hearing screening and assessment. As a result, children with hearing loss in these areas may go undiagnosed and miss out on early interventions that could mitigate the impact of their impairment (Majrooh et al., 2013).

Inadequate Awareness and Knowledge: A lack of awareness and knowledge about childhood hearing impairment among parents, caregivers, and healthcare providers can contribute to delayed identification of hearing loss. Many parents may not recognize the signs of hearing impairment in their children or may attribute them to other causes. Additionally, healthcare providers in some regions may lack the training and resources to conduct early hearing screening and may not prioritize it as a routine part of pediatric care (Krishnan & Donaldson, 2013).

Cultural Beliefs and Stigmas: Cultural beliefs and stigmas surrounding disability, including hearing loss, can further compound the challenges of early identification. In some communities, there may be a perception that children with hearing loss are "cursed" or bring shame to the family. Such attitudes may discourage families from seeking medical attention for their children's hearing difficulties, leading to delayed or missed opportunities for intervention (Wallhagen, 2010).

Lack of Standardized Screening Programs: The absence of standardized neonatal hearing screening programs in many healthcare facilities across Pakistan is a significant barrier to early identification. Neonatal hearing screening is a critical component of early detection, as it allows for the identification of hearing impairment in newborns before the age at which critical language and communication development occurs. Implementing universal newborn hearing screening programs can improve early detection rates and ensure that children with hearing loss receive timely interventions (Jamalullah, 2018).

Language and Cultural Diversity: Pakistan is a linguistically and culturally diverse country with multiple regional languages and dialects. This diversity poses challenges in developing standardized screening tools and educational materials for hearing screening and awareness campaigns. Screening materials and educational resources must be culturally and linguistically appropriate to effectively reach diverse communities (Wallhagen, 2010).

Lack of Data and Research: The lack of comprehensive data and research on childhood hearing impairment in different regions of Pakistan hinders the understanding of the prevalence, causes, and risk factors associated with hearing loss. More extensive studies are needed to provide a clear picture of the hearing health landscape across the country and to identify specific challenges faced by different communities (Olusanya et al., 2007).

Socioeconomic Factors: Socioeconomic factors can also impact the early identification of childhood hearing loss. Families from low-income backgrounds may face financial constraints that prevent them from seeking medical attention for their children's hearing difficulties. Additionally, children from disadvantaged backgrounds may have limited access to educational resources and support services, which can further exacerbate the impact of their hearing impairment on their educational outcomes (Sambah et al., 2020).

Parental Involvement and Follow-up: Parental involvement in the early identification process is crucial. However, challenges such as low health literacy and lack of awareness can hinder parents' ability to recognize the signs of hearing loss and seek appropriate support for their children. Furthermore, follow-up care and intervention services may be lacking or inaccessible in some areas, preventing children with identified hearing loss from receiving the necessary support and intervention (Fitzpatrick et al., 2017).

Lack of Coordination and Collaboration: The lack of coordination and collaboration among different stakeholders, including healthcare providers, educators, policymakers, and advocacy organizations, can impede efforts to improve early

identification of childhood hearing loss. A cohesive and coordinated approach is essential to develop and implement effective screening programs, raise awareness, and provide comprehensive support for children with hearing impairment (White et al., 2010).

Identifying and addressing the challenges in early identification of childhood hearing loss is essential to ensure that all children in Pakistan have access to timely and appropriate interventions. Strategies to overcome these challenges should include improving access to healthcare services, increasing awareness and knowledge about childhood hearing impairment, addressing cultural beliefs and stigmas, implementing standardized neonatal hearing screening programs, and conducting more extensive research to inform evidence-based interventions. By addressing these challenges, Pakistan can take significant strides towards improving the outcomes and quality of life for children with hearing loss and promoting inclusivity and equity in healthcare and education for all children. All above challenges from the literature review are listed in the below the Table-1:

Table 1: Challenges in Early Identification of Childhood Hearing Loss in Pakistan

Sr.	Authors	Research Title	Year	Challenges in Early Identification Quoted
1	Sambah et al.	"The Professional's experience with causes of delay in the diagnosis and management of children with a congenital hearing loss in Libya."	2020	Socioeconomic Factors
2	Jamalullah	"Newborn Hearing Screening: The Great Omission"	2018	Lack of Standardized Screening Programs
3	Fitzpatrick et al.	"Exploring reasons for late identification of children with early-onset hearing loss."	2017	Parental Involvement and Follow-up
4	Majrooh et al.	"Accessibility of antenatal services at primary healthcare facilities in Punjab, Pakistan"	2013	Limited Access to Healthcare Services
5	Krishnan & Donaldson	"Newborn hearing screening in developing countries: understanding the challenges and complexities of implementation."	2013	Inadequate Awareness and Knowledge
6	Wallhagen	"The stigma of hearing loss"	2010	Cultural Beliefs and Stigmas Language and Cultural Diversity
7	White et al.	"The evolution of early hearing detection and intervention programs in the United States"	2010	Lack of Coordination and Collaboration
8	Olusanya et al.	"Progress towards early detection services for infants with hearing loss in developing countries"	2007	Lack of Data and Research

DISCUSSION

The present study aimed to explore the challenges in the early identification of childhood hearing loss in Pakistan. The findings shed light on various factors that hinder the timely detection of hearing impairment in children, including limited access to healthcare services, inadequate awareness and knowledge about hearing screening, cultural beliefs and stigmas, lack of standardized screening programs, language and cultural diversity, lack of data and research, socioeconomic factors, parental involvement, and lack of coordination and collaboration among stakeholders. One of the primary challenges in early identification of childhood hearing loss in Pakistan is the limited access to healthcare services, especially in rural and underserved areas. Many families residing in remote regions do not have easy access to healthcare facilities equipped with the necessary resources for hearing screening and assessment. As a result, children with hearing loss in these areas may remain undiagnosed, leading to delayed interventions and potentially exacerbating the impact of their impairment on their overall development ((Majrooh et al., 2013).

The lack of awareness and knowledge about childhood hearing impairment among parents, caregivers, and healthcare providers is another significant barrier to early identification. Many parents may not recognize the signs of hearing impairment in their children, or they may attribute the symptoms to other causes, delaying seeking medical attention. Moreover, healthcare providers in some regions may lack the necessary training and resources to conduct early hearing screening, and they may not prioritize it as a routine part of pediatric care. Addressing this knowledge gap and raising awareness about the importance of early hearing screening is crucial to improving identification rates. Cultural beliefs and stigmas surrounding disability, including hearing loss, can further hinder the early identification of childhood hearing impairment. In some communities, there may be a perception that children with hearing loss are "cursed" or bring shame to the family. Such attitudes can discourage families from seeking medical attention for their children's hearing difficulties, leading to delayed or missed opportunities for intervention. Efforts to challenge and change these cultural beliefs and stigmas are essential to promote early identification and support for children with hearing loss (Wallhagen, 2010).

The absence of standardized neonatal hearing screening initiatives in numerous healthcare establishments throughout Pakistan poses a notable hindrance to timely identification. Neonatal hearing screening stands as a pivotal element in early detection, enabling the spotting of hearing impairment in newborns before the critical phase of language and communication development (Jamalullah, 2018). The implementation of all-encompassing newborn hearing screening programs holds the potential to enhance rates of early detection and ensure the prompt deployment of interventions for children afflicted by hearing loss. A collaborative endeavor involving healthcare providers, policymakers, and advocacy groups is imperative to establish and execute such programs nationwide. The diverse linguistic and cultural landscape of Pakistan introduces complexities in developing uniform screening tools and informative materials for hearing assessments and awareness campaigns. To effectively engage various communities, these materials and resources must be attuned to cultural and linguistic nuances. Alongside language considerations, fostering cultural awareness in healthcare practices is pivotal for motivating families to actively seek early identification and intervention services for their children grappling with hearing loss.

The lack of comprehensive data and research on childhood hearing impairment in different regions of Pakistan hinders the understanding of the prevalence, causes, and risk factors associated with hearing loss. More extensive studies are needed to provide a clear picture of the hearing health landscape across the country and to identify specific challenges faced by different communities. Longitudinal studies that follow children from infancy to childhood and beyond can provide valuable insights into the natural history of hearing loss and the impact of early interventions on long-term outcomes. Socioeconomic factors can also impact the early identification of childhood hearing loss. Families from low-income backgrounds may face financial constraints that prevent them from seeking medical attention for their children's hearing difficulties. Additionally, children from disadvantaged backgrounds may have limited access to educational resources and support services, which can further exacerbate the impact of their hearing impairment on their educational outcomes. Addressing socioeconomic disparities and providing equitable access to healthcare and educational resources are crucial steps in improving early identification rates.

Parental involvement in the early identification process is essential (Fitzpatrick et al., 2017). However, challenges such as low health literacy and lack of awareness can hinder parents' ability to recognize the signs of hearing loss and seek appropriate support for their children. Furthermore, follow-up care and intervention services may be lacking or inaccessible in some areas, preventing children with identified hearing loss from receiving the necessary support and intervention. Encouraging and empowering parents to be proactive in seeking early identification and intervention services for their children can significantly improve outcomes. The lack of coordination and collaboration among different stakeholders, including healthcare providers, educators, policymakers, and advocacy organizations, can impede efforts to improve early identification of childhood hearing loss. A cohesive and coordinated approach is essential to develop and implement effective screening programs, raise awareness, and provide comprehensive support for children with hearing impairment. Engaging all stakeholders in a collaborative effort to address the challenges in early identification can lead to more effective and sustainable solutions.

The challenges in the early identification of childhood hearing loss in Pakistan are multifaceted and require a comprehensive and collaborative approach to address them effectively. Improving access to healthcare services, raising awareness and knowledge about childhood hearing impairment, addressing cultural beliefs and stigmas, implementing standardized neonatal hearing screening programs, conducting more extensive research, addressing socioeconomic disparities, promoting parental involvement, and fostering coordination and collaboration among stakeholders are crucial steps towards achieving early identification and intervention for children with hearing loss. By overcoming these challenges, Pakistan can make significant strides in improving the outcomes and quality of life for children with hearing impairment and promoting inclusivity and equity in healthcare and education for all children.

To effectively control, prevent, and ensure early identification of hearing loss in Pakistan, a collaborative approach involving government, healthcare professionals, and communities is essential. The government should institute comprehensive policies mandating universal newborn hearing screenings in healthcare facilities nationwide, ensuring that every newborn undergoes hearing evaluation. Healthcare workers, including doctors and nurses, should be equipped with training to conduct these screenings and educate parents about the significance of early detection. Additionally, healthcare professionals should offer guidance and support to parents of children diagnosed with hearing loss, providing information on available interventions, such as hearing aids or cochlear implants, and facilitating access to specialized speech therapy and audiological services. By prioritizing early identification, awareness campaigns, and enhanced healthcare infrastructure, Pakistan can take significant strides in mitigating the impact of hearing loss on its children and fostering their optimal development.

Conclusions

The present article explored the challenges and barriers in the early identification of childhood hearing loss. Our in-depth literature review revealed several factors that contribute to delayed or missed detection of hearing impairment in children, leading to adverse effects on their overall development and quality of life. We also discussed the regional variations in the causes of hearing loss, highlighting the need for targeted interventions and screening programs in different parts of the country. Consanguinity, particularly first cousin marriages, emerged as a significant risk factor for childhood deafness in Pakistan. The prevalence of parental consanguinity was found to be high in certain regions, contributing to the increased risk of congenital hearing impairment in children. However, beyond consanguinity, other factors such as infectious diseases, genetic factors, and

environmental influences can also lead to hearing loss in children. The exact prevalence and impact of these causes in different regions require further research to develop more targeted interventions.

The challenges in early identification of childhood hearing loss in Pakistan are multi-dimensional and demand comprehensive strategies for effective solutions. Limited access to healthcare services, inadequate awareness and knowledge, cultural beliefs and stigmas, lack of standardized screening programs, language and cultural diversity, lack of data and research, socioeconomic disparities, parental involvement, and lack of coordination among stakeholders all contribute to the complex nature of the issue. To overcome these challenges, several key recommendations can be proposed. Implementing universal newborn hearing screening programs is crucial to identify hearing impairment in infants before critical language and communication development stages. This requires collaboration between healthcare providers, policymakers, and advocacy organizations to ensure equitable access to screening services across all regions.

Raising awareness and knowledge about childhood hearing impairment is essential to empower parents and caregivers to recognize the signs of hearing loss in their children and seek early medical attention. Culturally sensitive and linguistically appropriate educational resources and awareness campaigns are necessary to reach diverse communities effectively. Addressing socioeconomic disparities and providing equitable access to healthcare and educational resources are vital to ensure that all children with hearing loss receive timely interventions and support services. This includes efforts to enhance follow-up care and intervention services to provide comprehensive support for children with identified hearing loss.

Furthermore, conducting more extensive research and longitudinal studies across different regions of Pakistan is imperative to gain a comprehensive understanding of the prevalence, causes, and impact of childhood hearing impairment. Evidence-based data can guide policymakers and healthcare authorities in formulating targeted interventions and support systems. Fostering coordination and collaboration among stakeholders is essential to develop a cohesive approach in tackling the challenges in early identification. Healthcare providers, educators, policymakers, and advocacy organizations must work in unison to create a sustainable and inclusive system that addresses the needs of children with hearing loss.

In conclusion, the early detection of childhood hearing loss in Pakistan emerges as a pivotal issue within the realm of public health, necessitating a collective endeavor involving all parties concerned. Through tackling the obstacles and adopting strategies founded on solid evidence, we hold the potential to enhance results and elevate the standard of living for children dealing with hearing impairment. This endeavor simultaneously advances inclusivity and fairness in healthcare and education for all children throughout the nation.

RECOMMENDATIONS OF THE STUDY

Specific Recommendations

1. **Implement Universal Newborn Hearing Screening:** Introduce and expand universal newborn hearing screening programs across all healthcare facilities in Pakistan. Early detection of hearing impairment in infants is crucial to initiate timely interventions and support, facilitating better language and communication development.
2. **Raise Awareness and Knowledge:** Develop culturally sensitive and linguistically appropriate educational resources and awareness campaigns to empower parents, caregivers, and communities to recognize the signs of hearing loss in children and seek early medical attention.
3. **Enhance Access to Healthcare Services:** Address socioeconomic disparities and ensure equitable access to healthcare and educational resources for all children, especially those from marginalized and underserved communities. Provide support services and follow-up care to children with identified hearing loss.
4. **Strengthen Interdisciplinary Collaboration:** Foster coordination and collaboration among healthcare providers, educators, policymakers, and advocacy organizations to create a cohesive approach in tackling the challenges of early identification. This interdisciplinary collaboration can enhance the efficiency and effectiveness of interventions and support systems.
5. **Improve Data Collection and Research:** Conduct extensive research and longitudinal studies in different regions of Pakistan to gain a comprehensive understanding of the prevalence, causes, and impact of childhood hearing impairment. Evidence-based data is essential to guide future interventions and policy decisions.

RECOMMENDATIONS FOR FUTURE RESEARCHERS

1. **Explore Regional Variations:** Conduct in-depth regional studies to assess the prevalence and risk factors associated with hearing impairment in different parts of Pakistan. These studies can provide valuable insights into the specific challenges faced by children with hearing loss in various regions and inform targeted interventions.
2. **Investigate Genetic and Environmental Factors:** Further research is needed to investigate the contribution of genetic factors, environmental influences, and infectious diseases to childhood hearing loss in Pakistan. Understanding the prevalence and impact of these causes can guide more tailored interventions.
3. **Evaluate Intervention Strategies:** Evaluate the effectiveness of early intervention strategies, such as hearing aids, cochlear implants, and communication therapies, in improving language and communication outcomes for children

with hearing loss. Identify barriers to accessing these interventions and develop solutions to enhance their implementation.

4. **Assess Cultural and Linguistic Diversity:** Explore the influence of cultural and linguistic diversity on the early identification of childhood hearing loss. Investigate the impact of cultural beliefs and stigmas on seeking medical attention for hearing-related concerns.
5. **Monitor Long-Term Outcomes:** Conduct longitudinal studies to monitor the long-term outcomes of children with hearing loss who have received early interventions and support. Assess their educational achievements, employment opportunities, and overall quality of life to determine the effectiveness of early identification and intervention strategies.
6. By implementing these specific recommendations and addressing the areas for future research, we can make significant progress in overcoming the challenges of early identification of childhood hearing loss in Pakistan and ensure better outcomes for affected children.

CREDIT AUTHOR STATEMENT

Amna Jahangir: Writing- Original draft preparation, Data curation, **Rukhsana Bashir:** Conceptualization, Methodology, **Asma Kanwal:** Reviewing, Validation, Editing

COMPLIANCE WITH ETHICAL STANDARDS

It is declared that all authors don't have any conflict of interest. Furthermore, informed consent was obtained from all individual participants included in the study.

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