



IMPACT OF IMPLANTING A HEARING SCREENING PROGRAM: LITERATURE REVIEW

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Abstract:

This study explores the multifaceted impact of implanting a hearing screening program within a healthcare system. The research delves into the potential benefits, challenges, and overall effectiveness of such programs in identifying hearing impairments early on. Through a systematic review of existing literature, we examine the positive outcomes associated with early detection, including improved communication skills, academic performance, and psychosocial well-being. Additionally, the study scrutinizes the logistical and financial considerations involved in implementing and sustaining widespread hearing screening initiatives. The findings aim to contribute valuable insights to healthcare policymakers, practitioners, and stakeholders, facilitating informed decisions regarding the integration of hearing screening programs into public health initiatives.

Keywords: hearing screening program: Early detection: Early intervention

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1- Introduction:

Hearing loss is one of the most prevalent disabilities worldwide. According to the World Health Organization (WHO), about 360 million individuals suffer from hearing loss, of whom 32 million are children. WHO predicted in the World Report on hearing that by 2050, nearly 2.5 billion people will develop some degree of hearing loss, at least 700 million of whom need rehabilitation services (WHO, (2021) ⁽¹⁾). Early intervention is essential for people with hearing loss to achieve positive rehabilitation outcomes since delays have a negative impact on language development, communication, social well-being, and cognition. Hearing loss both in children and adults, it often goes unnoticed because it is invisible (Lieu, et al., (2020) ⁽²⁾).

There is many of literature showing that children whose hearing loss has been identified at an early stage and who receive early intervention have better outcomes than those who have been discovered and treated later. For this reason, certain procedures should be implemented to screen for hearing loss at different stages of life. Early identification and intervention in children became possible through the implementation of hearing screening programs such as newborn hearing screening and preschool hearing screening. Through the newborn hearing screening (NHS) program, it is possible to identify and treat newborns early. Its application improved the ability to identify and treat congenital hearing loss shortly after birth (Neumann et al., (2022) ⁽³⁾).

The most common techniques for hearing screening are otoacoustic emission (OAE) and automated auditory brainstem response (AABR). Worldwide, many newborns are not screened for hearing loss, and even when they are, those with progressive hearing loss or that develops later in childhood often remain unidentified and therefore untreated (Ruben, (2021) ⁽⁴⁾). Preschool screening provides a unique opportunity to have a comprehensive hearing screening among children. Once followed by prompt diagnosis and appropriate interventions, school (and pre-school) ear, and hearing screening programs serve as a valuable tool for reducing the effect of untreated hearing loss and ear diseases. They also provide an opportunity to educate children and teachers about healthy hearing and safe listening practices (Brodie et al., (2022) ⁽⁵⁾). Therefore, hearing screening programs have been implemented in many countries using a variety of screening methods, protocols, and links with healthcare. In this literature review, we will be discussed the impact of implementing hearing screening programs.

2- Literatures review:

Auditory input is essential for development and social functioning, so early awareness of a child's hearing ability is important in creating opportunities for early intervention. Until some years ago, distraction hearing screening (behavioral testing) was used for hearing screening around the age of 9 months in the Netherlands. In many developed nations, newborn hearing screening was implemented within two weeks after birth since it was believed that the earlier a persistent childhood hearing impairment was identified, the less at-risk for developmental issues children would experience. Between 2002 and 2006, all 65 regions in the Netherlands replaced distraction hearing screening with newborn hearing screening (van der Zee et al., (2022) ⁽⁶⁾).

A study was done by (Korver et al., (2010) ⁽⁷⁾) to determine the effect of newborn hearing screening vs distraction hearing screening on development, spoken communication, and quality of life. The was compared between two groups, which differed in the age at screening and the method used; both followed uniform protocols. The first group was Newborn hearing screening for good infants, offered before the age of 2 weeks, is also a 3-stage screening program, but it uses transient evoked otoacoustic emissions for the first 2 stages and automated auditory brainstem responses in the third stage. And then another group was Distraction hearing screening, offered at the age of 9 months, which is a 3-stage hearing screening using sounds to provoke a behavioral reaction.

There were 234,826 babies born in the distraction hearing screening region and 335,560 babies in the newborn hearing screening region. At follow-up, 263 children in newborn hearing screening regions (0.78 per 1000 children) and 171 children in distraction hearing screening regions (0.73 per 1000 children) had been identified as having a permanent childhood hearing impairment. Which was defined as bilateral permanent conductive or sensorineural hearing loss of 40 dB or greater in the better ear using frequency (500, 1000, and 2000 Hz). Hearing loss was classified as moderate (40-60 dB), severe (61-90 dB), or profound (<90 dB). The study results showed that newborn hearing screening, compared with distraction hearing screening, was associated with statistically significantly fewer words signed and better overall, social, and gross motor development and quality of life at 3 to 5 years of age among children with permanent hearing impairment. However, it is important to realize that despite early hearing screening, the development of children with permanent childhood hearing impairment at age 3 to 5 years following newborn hearing screening is

still not comparable with that of normally developing children with normal hearing.

The Joint Committee on Infant Hearing recommends that intervention following positive results for hearing impairment and confirmation of permanent childhood hearing impairment should start no later than age 6 months. In this study, however, this recommendation was not always achieved and this delay between identification and amplification might have resulted in a reduction of the developmental differences between newborn and distraction hearing screening groups in this study. It is possible that after the closure of data collection, very late-onset hearing loss was missed, especially in children born in the later years of the study.

The newborn hearing screening program aims to reduce the age of hearing assessment and intervention for children with hearing impairments. Several countries have begun to implement hearing loss screening and interventions and are conducting regional (UNHS) programs.

A retrospective cohort study done by (Faistauer et al., (2022) ⁽⁸⁾) aims to evaluate the impact of universal newborn hearing screening (UNHS) at three moments, age at diagnosis, the beginning of treatment, and those who indicated cochlear implant (CI) surgery in Brazilian children. It included a sample size of 135 children with bilateral hearing loss (in the age range of 0 to 12 years old). The sample was divided into two groups, group 1, patients who undergo to UNHS (102 children), and group 2 who didn't undergo UNHS, (33 children). The group who underwent UNHS was also subdivided into group 1 between children who passed (group A) and those who don't pass (group B) at the screening. The groups were compared according to their ages at the three moments. The results of the study showed the initial treatment was to use hearing aids (HA) only for 128 children from the total sample because 6 of them were lost to follow-up and 1 had parents who chose not to use HA. Of these 128 patients, 67 had a poor response to the use of hearing aid and were evaluated by a multidisciplinary team (the remaining 61 had sufficient hearing gain and stayed with the HA). As for children who had a poor response to initial treatment (67 patients), one was considered a candidate for an auditory brainstem implant (ABI) and 66 for CI. Of these 66 patients, only 46 children performed CI surgery (38 had undergone UNHS who are they 30 don't pass the hearing screening and 8 passed the hearing screening), (8 didn't undergo UNHS; 9 were still awaiting surgery, 5 were lost to follow-up and 6 had families who chose not to perform surgery).

The study found also the median age for the whole sample (135 patients) at the first appointment was 1.42 years, at the beginning of treatment 2.00 years, and at the cochlear implant surgery 2.83 years. Additionally, the median age for those who underwent UNHS at the first appointment was 12.5 months, at the beginning of treatment was 22 months, and at the CI was 33.5 months for these patients. Also, the results of those who don't undergo UNHS were median age at the first appointment was 30 months, at the beginning of treatment was 39 months, and at the CI was 50 months for these patients. As for groups (A and B), the median age among the 102 patients who underwent UNHS in the study's sample, and passed the screening tests (group A) at the first visit was 1.79 years, at the beginning of treatment was 2.66 years, and at the CI was 3.58 years for these patients. Those who underwent UNHS and didn't pass (group B) were median age at the first visit was 0.83 years, at the beginning of treatment was 1.33 years, and at the CI was 2.58 years for these patients. The results suggested to children who underwent UNHS were younger than those who didn't, at the three evaluated moments. In addition, children who passed the UNHS but were later diagnosed with hearing loss reached the first appointment and started treatment older than those who failed the tests (don't pass UNHS).

The study highlighted the importance of newborn hearing screening in all hospitals. Also, specialists who follow young children must be very alert to confirm whether children who fail to screen are properly referred and also if children who pass in UNHS end up showing signs of late-onset hearing loss.

Another study conducted by (Philips, et al., (2009) ⁽⁹⁾) using a sample of 391 implanted children that were sorted into two groups (195 were early screened, 196 were late screened). Several characteristics were compared between the two groups to evaluate the effect of a newborn hearing screening program on the management and outcome of deaf children. The study found that children who were screened early had hearing loss detected on average at the age of 5 months, compared to children who were screened late, who had hearing loss detected on average at the age of 14 months. Additionally, the study found that the mean age of implantation for early-screened children was 22 months, compared to 71 months for late-screened children, suggesting that late-screened children were implanted 49 months later on average than early-screened children. Additionally, early screening and implantation are linked to improved speech intelligibility and auditory receptive abilities; as a result, children

who were evaluated early and subsequently received early intervention and implantation had better outcomes on categorical auditory performance and speech intelligibility rating tests, unlike late screened children. However, one limitation of this study is that the number of children in the sample was limited, reflecting a result that is not very convincing.

Preschool hearing screening, newborn hearing screening (NHS) has become the standard of practice in hospitals worldwide which aims to detect infants with hearing loss as early as possible. A study conducted by (Yong et al., (2020)⁽¹⁰⁾. The main purpose of the study was to review the school hearing screening programs applied around the world and identify research gaps that support school hearing screening. The study focused on reviewing 65 articles about hearing screening. The researchers selected the articles that included age groups screened, audiometric protocols, referral criteria, use of adjunct tests, presence of a rescreen protocol, estimates of hearing loss prevalence, sample size of children screened, screening test performance characteristics, and loss to follow-up. The data was collected and displayed on tables. After comparing and evaluating the data of the 65 articles, the study concluded that school hearing screening was not obligatory except in a few regions around the world. In addition, there was no clear evidence that the testing hearing was performed or not.

Moreover, most of the studies did not focus on the rescreening process. The study also concluded that the hearing screening protocols differ in respect of tests. Pure tone screening (0.5, 1, 2, and 4 kHz), otoscopy, and tympanometry were the most frequently used testing methods. The findings also stressed that there is an obvious loss of follow-up. Only eight studies out of forty-four stressed that follow-up ranges from 10% to 65%. The reasons behind such loss were due to the ignorance of the parents of its importance, the cost, and other minor reasons. Thus, the aim of this study was to trace back the previous studies that investigated school hearing screening programs around the world and highlighted the research gaps which support school hearing screening.

3- Conclusion:

This literature review's purpose is to help the reader understand the impact of the implementation of hearing screening program. Many people often not realizing there the amount of benefit the hearing screening program offers. There has been much research and discussion conducted to determine the effect of implementing a hearing screening program. Most of the research found patients

whose hearing loss is identified at an early stage and who receive early intervention have better outcomes than those with later detection and treatment. It is important to conduct more studies on the limitation and adverse of hearing screening programs.

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We would love to offer this modest effort to all the faithful who wish to develop related health services to citizens and residents in the Holy Capital, ask God that we have been successful in the output of this business as desired Amen.

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