

Evaluation of the implementation of a newborn hearing screening protocol specific to children with risk indicators in a public maternity in Minas Gerais

Avaliação da implementação de um protocolo de triagem auditiva neonatal específica para crianças com indicadores de risco em uma maternidade pública de Minas Gerais

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ABSTRACT

Objective: to evaluate the results of the implementation of a specific newborn hearing screening protocol as well as to describe the protocol quality indicators and verify the occurrence of risk indicators for hearing impairment. **Methods:** all newborns (NB) in a public maternity belonging to the group at risk for hearing impairment and showing one or more risk indicator were included. Medical charts data from the newborn hearing screening program were compiled between May of 2011 and April of 2013. The evaluated quality indicators were: scope of examinations of newborns at risk, evasion rates for retesting, and diagnosis and follow-up in accordance with the proposed protocol. **Results:** 362 NBs were included. Out of the evaluated records, 258 NBs (71.3%) presented the “passed” result in the screening and 104 (28.7%) “failed”. A total of 111 NBs (30.7%) were discharged and 36 (9.9%) referred for diagnosis; 176 (48.6%) did not return to complete the evaluation, 37 (10.2%) have not yet completed the evaluation, and two (0.6%) died. **Conclusion:** 93.1% of NBs at risk were screened. The most prevalent risk indicator was “neonatal intensive care for more than five days of life”. The number of risk indicators found ranged from one to five per neonate. The protocol still shows a high evasion index, both for retesting and diagnosis and monitoring.

Key words: Risk Index; Hearing Loss; Neonatal Screening; Early Diagnosis; Hearing, Infant, Newborn.

RESUMO

Objetivo: avaliar os resultados obtidos da implantação de protocolo de triagem auditiva neonatal específica, bem como descrever os indicadores de qualidade do protocolo e verificar a ocorrência de indicadores de risco para deficiência auditiva. **Métodos:** foram incluídos todos os recém-nascidos (RN) em uma maternidade pública, pertencentes ao grupo de risco para deficiência auditiva, apresentando um ou mais indicadores de risco. Foram compilados os dados dos prontuários do programa de triagem auditiva neonatal, no período compreendido entre maio de 2011 e abril de 2013. Os indicadores de qualidade avaliados foram: abrangência de exames dos recém-nascidos de risco, taxas de evasão para reteste, diagnóstico e acompanhamento, de acordo com o proposto pelo protocolo. **Resultados:** foram incluídos 362 RNs. Do total de prontuários analisados, 258 RNs (71,3%) apresentaram resultado “passa” na triagem e 104 (28,7%) “falha”. Tiveram alta 111 RNs (30,7%) e 36 (9,9%) foram encaminhados para o diagnóstico, 176 (48,6%) não retornaram para concluir a avaliação, 37 (10,2%) ainda não concluíram a avaliação e dois (0,6%) faleceram. **Conclusão:** 93,1% dos RNs de risco foram triados. O indicador de risco mais prevalente foram “cuidados intensivos neonatais por mais de cinco dias de vida”. O número de indicadores de risco encontrado em cada neonato variou de um

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a cinco. O protocolo ainda apresenta índice de evasão elevado, tanto para os retestes como para o diagnóstico e acompanhamento.

Palavras-chave: *Indicador de Risco; Perda Auditiva; Triagem Neonatal; Diagnóstico Precoce; Audição; Recém-Nascido.*

INTRODUCTION

Early detection and therapeutic intervention in newborns (RNs) with hearing loss are essential to minimize its effects and influence on the quality of life.¹ The objective of the hearing screening and early intervention program is aimed at children with hearing loss to get the most out of language proficiency and improved reading and writing development. Therefore, the identification of children with hearing loss before three months of age and the start of intervention before six months of age are necessary.¹

The recommendations of the Universal Newborn Hearing Screening (TANU) seek to identify risk factors for permanent hearing impairment in childhood and depend on the following observations:¹

- concerns of parents and/or caregivers about delays in hearing, speech, language, or development;
- the family history of permanent hearing loss in childhood;
- neonatal intensive care for more than five days;
- congenital infections such as cytomegalovirus, herpes, rubella, syphilis, and toxoplasmosis;
- craniofacial anomalies;
- physical aspects such as white strands, which are associated with syndromes that include sensorineural or permanent conductive hearing loss;
- syndromes associated with hearing loss;
- neurodegenerative disorders such as Hunter syndrome, or sensorimotor neuropathies such as Friedreich's ataxia and Charcot-Marie-Tooth syndrome;
- post-natal infections with positive culture associated with sensorineural hearing loss including the confirmation of bacterial and viral meningitis;
- head trauma;
- chemotherapy.

In developed countries, sensorineural hearing loss affects one in 1,000 newborns; 40% of cases can be attributed to hereditary factors, 30% to the various acquired conditions, and 20% to unknown etiology.²

The quality indicators for the hearing screening program, as recommended by the Multidisciplinary

Committee on Hearing Health (COMUSA, 2009) should include: conducting the Newborn Hearing Screening (TAN) at least in 95% of live RNs, with attempts to reach 100%; perform this screening during the first month of life; achieve a rate of less than 4% of children referred for diagnosis; attendance to diagnosis of at least 90% of referred children, with completion of diagnosis up to three months of life and adaptation of individual hearing aid in 95% of infants confirmed with permanent bilateral or unilateral hearing loss within one month after diagnosis.²

Since the implementation of the State Program of Newborn Hearing Screening in Minas Gerais, all screening tests in the municipality of Belo Horizonte are scheduled at the health units. However, RNs with risk factors for hearing loss are submitted to newborn hearing screening at the maternity before hospital discharge.

The Specific Neonatal Hearing Screening Protocol (TANE) was developed and implemented in the public maternity of the University Hospital of the State of Minas Gerais in 2011 where the study was conducted and after the identification of a high index of hearing screening evasion after discharge.

This study aimed to evaluate the results obtained in the TANE protocol in a public maternity of a university hospital in Belo Horizonte since its implementation to describe its quality indicators and verify the occurrence of risk indicators for hearing loss.

METHODS

This was a descriptive cross-sectional observational study of RNs' medical records from May of 2011 to April of 2013 in a public maternity hospital in the state of Minas Gerais belonging to the TANE protocol. The study was approved by the Ethics Committee in Research of the Institution under opinion 577/11.

The analyzed data were compiled from medical records in the Hearing Screening Program and TANE scheduling agencies located in the Secretary of neonatal unit of the studied hospital. The following data were analyzed: gender, gestational age, the risk for hearing loss, and TAN result. Data were organized in Excel 2010[®] spreadsheets (Microsoft Corporation) and analyzed descriptively for the preparation of tables and figures.

Between May of 2011 and April of 2013, 418 children born in the public maternity of the university hospital were included in the TANE protocol. Of

these, 27 (6.5%) RNs were not evaluated, although exams had been scheduled by responsible professionals. According to the analysis, most of these RNs were discharged prior to the examination date, and a new date was not rescheduled. Moreover, it was not possible to locate seven medical records.

Another important fact to mention was that 22 RNs were scheduled for the TANE protocol regardless of not presenting risk factors for hearing loss. The reasons could not be clarified. Thus, 362 newborns were included in the study.

In the TANE protocol, RNs with risk indicators for hearing loss (IRDA) are assessed in their own neonatal unit before hospital discharge. The implementation of the TANE protocol requires all staff involved in the care of pregnant women and infants including doctors, nurses, nursing technicians, speech therapists, secretary of the neonatal unit, unit manager, and director, who were informed about the objectives and roles to play according to their occupation. The objectives of this protocol are:

- to systematize the care of RNs with risk factors for hearing loss based on the best available scientific evidence;
- to ensure the first care to RNs with risk factors for hearing loss;
- to improve the care to RNs with risk factors for hearing loss;
- to enhance the human and material resources of the institution for cases requiring in-hospital TAN.

All RNs in the public maternity of the university hospital belonging to the group at risk for hearing loss with at least one of the risk factors for hearing loss were admitted to the TANE protocol (Table 1).

Under the proposed protocol, RNs belonging to the risk group and in stable health condition should be submitted to the first hearing screening at most seven days prior to hospital discharge. RNs belonging to the risk group may be admitted to the common-joint unit or neonatal unit (intensive care unit, intermediate care unit, or kangaroo care ward).

The TANE exam is conducted in the office of the neonatal unit, two days a week. Up to four RNs can be examined per day, totaling eight RNs per week. Untested RNs and with discharge scheduled before Tuesday or Friday are scheduled for a hearing screening in the speech therapy clinic. The RN, who remains hospitalized at the time of retesting, is subjected to this exam in the maternity.

Table 1 - Risk indicators for the Newborn Hearing Screening Specific Protocol

Risk indicators
1. Family history of congenital hearing loss.
2. Congenital infections: cytomegalovirus, herpetic, rubella, toxoplasmosis, and syphilis.
3. Craniofacial anomalies including outer ear, ear canal, pre-earlobe creases, and temporal bone abnormalities.
4. Physical findings associated with syndromes that include hearing loss such as presence of hair white streak.
5. Post-natal infections associated with hearing loss such as bacterial meningitis.
6. Head trauma and temporal fractures requiring hospitalization.
7. Neonatal intensive care for more than 5 days.
8. Assisted Ventilation.
9. Exposure to ototoxic drugs.
10. Hyperbilirubinemia requiring exchange transfusion.

According to the protocol (Figure 1), when the RN response is adequate, he is forwarded to the outpatient speech therapy clinic for follow-up on auditory development because of risks of late or progressive hearing loss. Parents and/or guardians are advised to attend the consultation that is scheduled six months after the first evaluation. The RN is forwarded to the speech therapy clinic for retesting with the Otoacoustic Emissions (EOA) method in a maximum of 15 days when the response is not adequate in the company of parents and/or guardians. In addition, all parents and/or guardians are given a folder from the State Health Secretary with guidance on what is being performed. The professional evaluates the child and records the screening using a specific form, which is then stored.

Screening procedures include the Otoacoustic Emissions exam and observations on auditory behavior performed by a speech therapist. The EOA records sound energy generated by the cochlea cells in response to sounds emitted in the external auditory canal of the RN. The Otoacoustic Emissions by Transient Stimuli (EOAT) are routinely performed at screening, retesting, and following-up visits.

Tests performed when RNs are referred to diagnosis include the EOATs and EOA by Distortion Product, Imitancimetry, and Brainstem Auditory Evoked Potential (PEATE).

The following quality indicators are considered in the TANE protocol:

- to evaluate at least 95% of newborns with risk indicator;
- to not exceed the rate of 4% of referrals for diagnosis;
- to achieve an attendance of at least 90% of referred RNs.

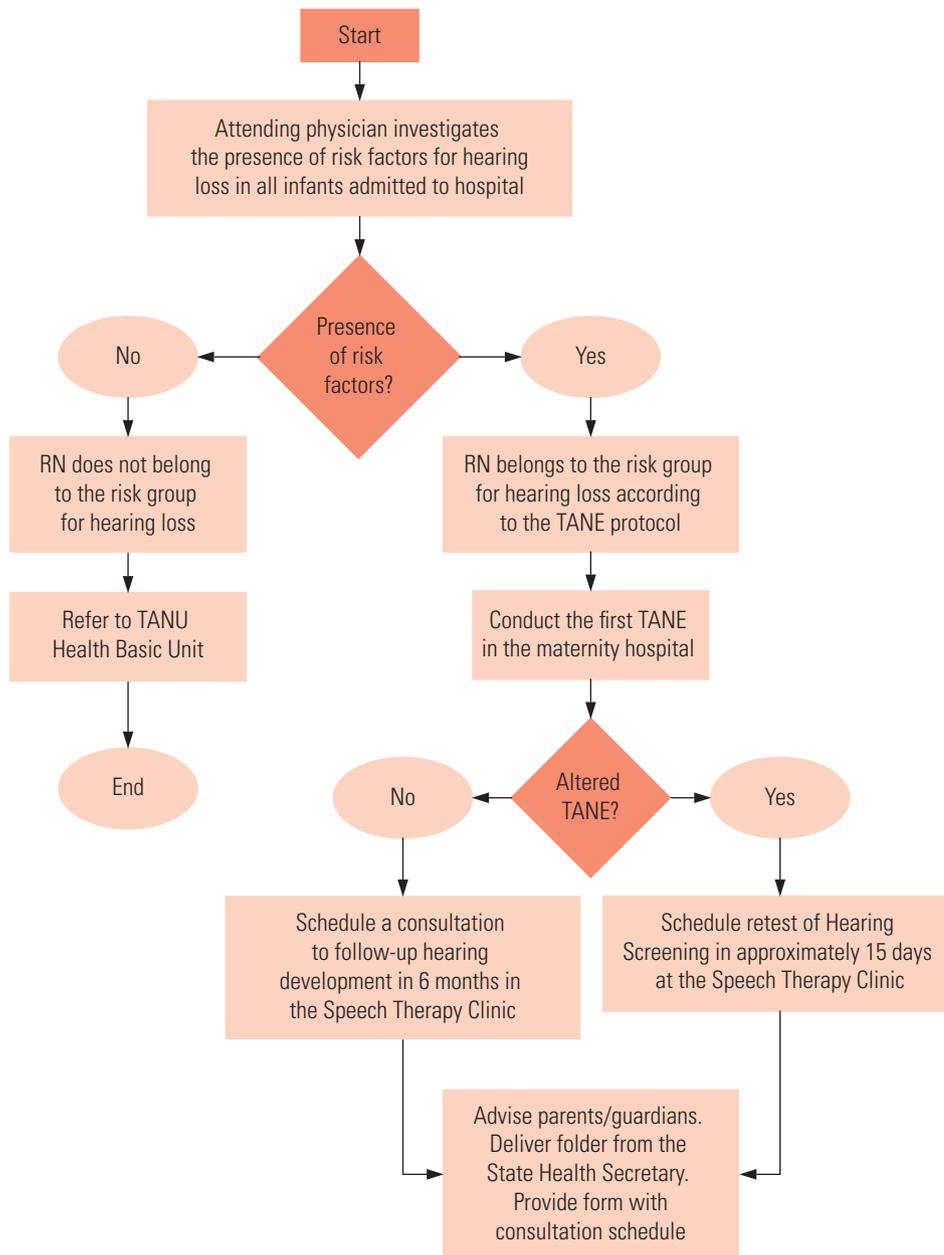


Figure 1 - Fluxogram of assistance through the Newborn Hearing Screening Specific Protocol.

RESULTS

This study included 362 RNs, including 168 (46.4%) girls and 194 (53.6%) boys. The average age of RNs at screening was 31 days old. The length of stay in the Intensive Care Unit (UTIN) ranged from five to 150 days, averaging 22 days.

Of all the medical records analyzed, 258 (71.3%) RNs obtained the result “passed” in the screening and 104 (28.7%) “failed”.

All 258 RNs, who had “passed” in the screening, were referred for follow-up (Figure 4). Of these,

105 (40.7%) attended, 119 (46.1%) did not attend, and one (0.4%) died; 33 (12.8%) reevaluations were scheduled but had not yet been conducted during the study period. Among the 105 RNs who attended the follow-up consultations, 94 (89.5%) had results as “passed” and 11 (10.5%) as “failed”. Among the RNs who have obtained the result “passed”, 91 (96.8%) were discharged, and three (3.2%) were scheduled for follow-up; of these three, two (66.7%) did not attend, and only one (33.3 %) attended and was discharged. In turn, among the 11 RNs who obtained a result “failed”, two (18.2%)

were referred for diagnosis and nine (81.8%) were scheduled for follow-up; of these, six did not attend, and three attended. Among the three who attended, two (66.7%) had results as “passed” and were discharged, and one (33.3%) as “failed” and was referred for diagnosis (Figure 2).

Out of the 104 RNs with the result as “failed” and scheduled for a retest, 75 (72.1%) RNs attended while 29 (27.9%) did not attend (Figure 3). Among the 75 RNs who attended the retest, 40 had results as “passed” (53.3%) and 35 (46.7%) as “failed”. Among the 40 RNs with the result as “passed”, four (10.0%) were discharged, and 36 (90.0%) were scheduled for follow-up. Of these 36 follow-up cases, 18 (50.0%) did not attend, 14 (38.9%) attended, and four (11.1%) had not been evaluated during the study period. Among the 14 RNs who attended, nine (64.3%) achieved the result “passed” and were discharged and five (35.7%) “failed” with one (20.0%) being referred to diagnosis and four (80.0%) scheduled for follow-up. Among the four scheduled reassessments, three (75.0%) had the result “passed” and were discharged and one (25.0%) was referred for diagnosis. Among the 35 RNs who obtained result “failed” in the retest, 31 (88.6%) were referred for diagnosis and four (11.4%) were scheduled for a new retest; of these, two (50.0%) did not attend, one (25.0%) died, and one (25.0%) attended and was discharged.

Table 2 shows the results and quality indicators in relation to monitoring all RNs that were included in the TANE protocol. The evasion rate corresponded to RNs who did not attend to all consultations until the evaluation was finalized.

Regarding the risk factors for hearing impairment, Table 3 shows the distribution of indicators found in 362 RNs included in the study.

RNs included in the TANE protocol could have one or more risk factors. The number of risk factors indicators present in each evaluated RN varied from one to five (Figure 4). It was observed that most RNs exhibited one or two risk indicators.

DISCUSSION

Hearing screening performed according to the TANE protocol found the average age of RNs as 31 days old. TAN should be performed until the first month of life in RNs.² Studies found in the literature that evaluated the quality and results of TAN programs reported a variation of 16-30 days of life and average of 42 days for the screening.^{3,4} Considering that the present study has a population at high risk as a sample, the stay in the UTIN, for example, interferes with RN age for screening. The length of stay in the UTIN in this study ranged from five to 150 days, averaging 22 days.

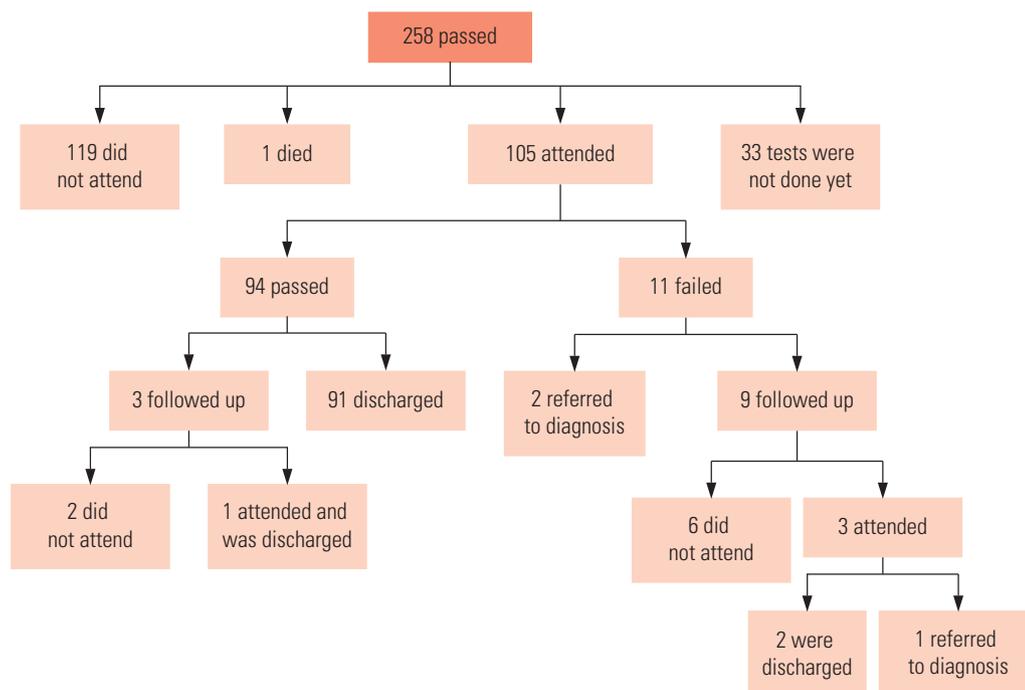


Figure 2 - Fluxogram of the follow-up assistance to newborns with normal results after screening.

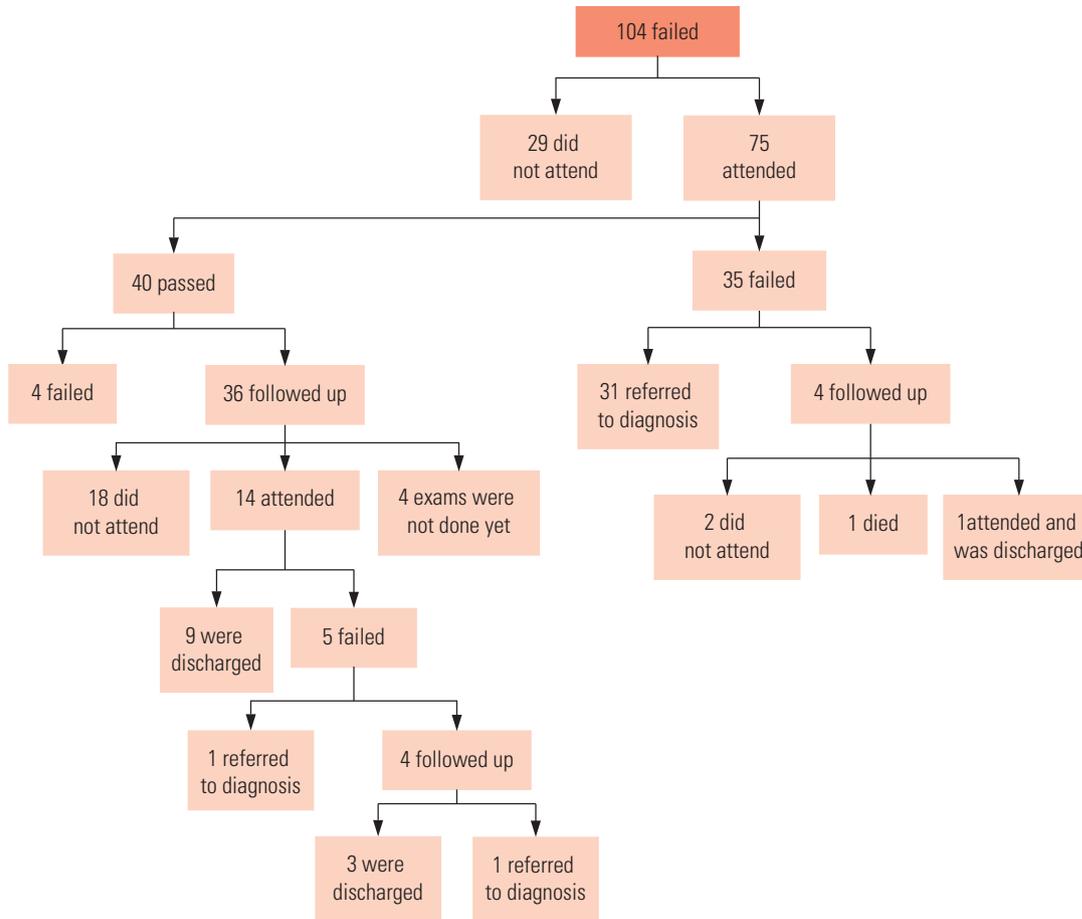


Figure 3 - Fluxogram of the follow-up assistance to newborns with altered results after screening.

Table 2 - Results and quality indicators

Results and quality indicators	N	%
Discharge	111	30.7
Referral to diagnosis	36	9.9
Evasion	176	48.6
Incomplete evaluation	37	10.2
Death	2	0.6
Total	362	100

Regarding the results found in the screening, out of the 362 RNs who had risk indicators for hearing loss, 71.3% had the result “passed.” This result corroborates the findings of Marone et al.⁵, who conducted screening in a university hospital in São Paulo. In this study, among the 65 RNs with risk factors for hearing loss (IRDA), 75.4% achieved the result “passed” and 24.6% “failed” in the screening.⁵

It is noteworthy that studies involving RNs with and without IRDAs in the sample reported better

results in the screening, finding values of 83, 88.3, and 89.3% of RNs with result “passed” in the first exam.⁶⁻⁸ The difference in the first stage of screening between RNs with and without IRDAs was observed by Rodrigues et al.⁹ These authors reported that in the first stage of screening 91.24% “passed” in the low-risk group and 65.85% in the high-risk group.

In this study, 104 RNs obtained a result “failed” in the screening and of these, 29 (27.9%) did not attend the retest; this result is superior to that found in other studies reporting evasion rates ranging between 7.2, 24, and 24.3%.^{3,6,10} A wide variability in evasion rates is reported in these studies, which may be related to methodological issues, differences in provided support services, existence of guidance programs, and public awareness programs about the relevance of the screening, and the socioeconomic and cultural condition of the population benefiting from the screening, among other possible factors.

Table 3 - Hearing loss indicators found in 362 newborns submitted to the neonatal hearing screening specific program

Hearing loss indicators	N	%
Neonatal intensive care for more than 5 days	285	41.5
Exposure to ototoxic drugs	157	22.9
Assisted Ventilation	108	15.7
Craniofacial anomalies	43	6.3
Family history of congenital hearing loss	31	4.5
Congenital infections	26	3.8
Physical findings associated with syndromes that include hearing loss	21	3.1
Hyperbilirubinemia requiring exchange transfusion	12	1.7
Post-natal infections associated with hearing loss	4	0.6
Head trauma and temporal fractures requiring hospitalization	0	0
Total	687	100

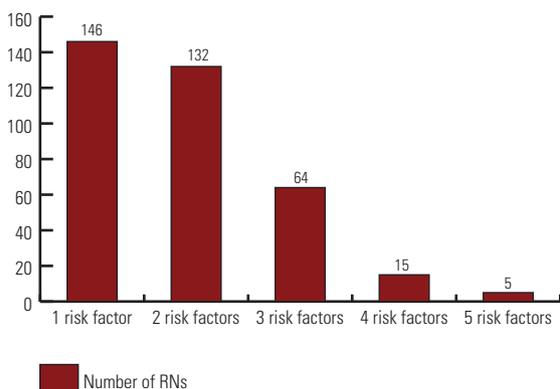


Figure 4 - Distribution of the number of risk factors for hearing loss by evaluated newborns.

The overall evasion rate in this study was 48.6% considering evasion in all stages of the TANE protocol. The result found is higher than that described in the literature when compared to the study conducted in southern Brazil with 2,165 children where the evasion rate found was 25%.⁶ Although the reasons for evasion were not researched in this study, some studies suggest the possibilities of: flaws in the educational process of professionals, lack of interest and awareness of responsible parties, economically disadvantaged families, low attendance to prenatal consultations, and low education level among mothers.^{9,11} Therefore, an enhanced approach is needed about the importance of hearing in the child’s development and the importance of an early detection of hearing loss, especially in the prenatal, postpartum, and neonatal visits for evaluation of hearing screening.¹¹

In another study conducted in a public maternity hospital in São Paulo in order to study the TAN process and the impact of its results, interviews were conducted with those responsible for RNs. The results revealed that most demonstrated having no prior knowledge about TAN and stated preferring to receive information before pregnancy in order to have prior knowledge and eliminate doubts about the screening.¹² Thus, the very staff of the basic health units could collaborate in an active search, in bringing awareness to those responsible for RNs, and in the development of health education strategies, seeking the effective participation of family members, who in turn can contribute to an improved functioning of the screening program and early diagnosis.^{13,14}

In this study, 9.9% of RNs were referred for diagnosis. This rate was higher than recommended by national and international guidelines,^{1,2,15} which provide up to 4% referral. However, it is noteworthy that these recommendations refer to all screened population (infants with and without IRDAs). In a study of 993 RNs, the referral index for diagnosis was 8.6%, lower than that in this study but still higher than advocated.¹⁶ A study of RNs with risk factors reported 26.7% of referrals for diagnosis, which is a result higher than found in this study.⁴ These results also reflect the difficulty of programs to achieve the recommended rate.

It was not possible to identify the total number of RNs diagnosed with hearing impairment because of the absence of some information in the medical records. Thus, it was not possible to establish the average age of diagnosis and age of intervention for the whole population served during the evaluated period.

Regarding IRDAs in the sample, the risk indicator with the highest prevalence was “neonatal intensive care for more than five days.” According to the authors, the need for intensive care and, therefore, stay in the UTIN leads to risk of hearing impairment when the stay period is more than five days, and thus, this is a risk indicator of great prevalence.^{1,17-19}

Exposure to ototoxic drugs was also very present and occurred concurrently with the length of stay in the UTIN for more than five days. The study obtained an important percentage, which corroborated other studies describing the exposure as one of the major IRDAs.^{3,7} These results corroborate the findings of Sgorla et al.¹⁶ and Barbosa et al.²⁰, who found the stay in the UTIN for more five days and use of ototoxic drugs as one of the risk indicators of highest prevalence among RNs.^{16,20}

According to the COMUSA (2009) recommendation, the TAN coverage must be conducted in at least 95% of live RNs, which was not observed in this study. Considering the results found for all RNs at high risk totaling 389, 27 (6.9%) did not undergo screening.

CONCLUSION

The highest incidence regarding risk indicators was the “neonatal intensive care stay for more than five days” followed by the use of ototoxic drugs and assisted ventilation. The number of risk factors found in each RN ranged from one to five.

A total of 93.1% coverage was observed among quality indicators evaluated in the TANE protocol at the University Hospital. The protocol implementation certainly favored this outcome. However, it also alerts to the need for improvement in the scheduling and compliance of consultations to obtain results above 95%.

The implementation of the TANE protocol provided improved quality of assistance to the population at risk for hearing loss; monitoring of this population identified the weak points in the system that allow changes to be implemented in the pursuit of better results.

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