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Original articles

Analysis of a hearing loss identification and intervention program in the first years of life in primary care

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ABSTRACT

Purpose: to analyze the implementation and effectiveness of a hearing loss identification and intervention program in the first years of life in primary care.

Methods: an experimental study carried out in two Basic Health Units. Twenty-three Community Health Workers participated, trained through an online self-instructional course from the Ministry of Health. Subsequently, they followed the hearing and language of children from zero to two years old, referring them, if necessary, to audiological evaluation. For the analysis of pre and post online course knowledge, the Wilcoxon test was applied, and to compare the performance between the participants of the two Basic Health Units, the Mann Whitney test was used, adopting $p<0.05$. Additionally, the qualitative perception of participating community workers, the referrals, and the result of the audiological evaluation were analyzed.

Results: the online course was effective in improving the knowledge of the participants. A total of 102 children were monitored, 15 of them were referred for evaluation. From these, four underwent hearing screening and 11 underwent a complete hearing assessment, a case of conductive hearing loss being identified.

Conclusion: the implementation of a program for the identification and intervention of hearing loss, in the first years of life, in primary care, permeated by community health workers, is feasible.

Keywords: Hearing Loss; Community Health Workers; Inservice Training; Primary Health Care

INTRODUCTION

It is a worldwide consensus that National Health Systems should be based on strong and resolute primary health care, that is, the expansion and qualification of this level of care have been seen as the main initiatives to produce qualitative changes in health for the coming decades. In Brazil, there is still a long way to go, mainly due to the low investment aimed at this level of care, which is around 19% of the total budget directed to health[1].

However, even in this scenario, important programs are developed, including the Family Health Strategy and Community Health Workers (CHW). When considering specifically the area of hearing health, the performance of these professionals is recommended by the World Health Organization[2] (WHO) since 1998 and reaffirmed in the National Primary Health Care (PHC) Policy (*Política Nacional de Atenção Básica*, PNAB)[3].

According to the Neonatal Hearing Screening care guidelines (NHS) of the Ministry of Health (MS)[4], monitoring of hearing development in primary health care is provided. Additionally, preventive actions and guidance to the population would be fully conceivable, and the performance of professionals at this level of care could directly influence the control of cases, since about 60% of hearing loss in childhood is preventable[5,6] and, most of the time, could be avoided with the implementation of public health actions[5,7].

However, this reality is still unusual at the national level. For the advancement of the activities, it is necessary to bring to the center of the performance of these professionals the theme of hearing, which includes permanent education policies and changes in professional training processes, as presented in the National Permanent Education Policy in Health (NPEPH)[8].

The specific literature demonstrates that CHW play an important role in the promotion and surveillance of children's hearing health. Among the various tools and strategies developed are in-person training[9], by videoconference[10], Cybertutor[11] and CD-ROM[12]. All are effective, but without free access on a national scale.

In this sense, the first course related to hearing health was developed in the virtual learning environment of National Health System (AVASUS/ Ministry of Health), which is entitled *"Actions in primary care for early identification of hearing impairment"* and has as target audience the CHW, available at: https://avasus.ufrn.br. The availability of this course on the platform allowed wide access throughout Brazil and abroad, also reaching other categories of professionals who were interested in the subject[13]. Although with free access, the online course does not guarantee that the learning will be put into practice in the daily work routine of the CHW[13,14]. Therefore, it is essential to analyze more directly the application of knowledge in daily life, that is, to measure the impact of online training in the reality of this professional.

Considering that the CHW is the main link with the community, by maintaining direct contact with a considerable number of families, the hypothesis of this study is that enabling them in this specific area becomes a potentiating action to expand the scope of actions in hearing health with quality. In addition, these professionals can contribute to minimize the evasion of families in the different stages of the hearing loss identification and intervention program in the first years of life[12-17].

Given the above, the present study aimed to analyze the implementation and effectiveness of a program for identification and intervention of hearing loss in the first years of life in primary care.

METHODS

This is an experimental study in the realm of health assessment, with a longitudinal design, approved by the Research Ethics Committee of the University Hospital Onofre Lopes of the Federal University of Rio Grande do Norte - HUOL/UFRN, Brazil, under protocol number 3.825.237 and CAAE: 98129718.8.0000.5292. This research was conducted by signing the Informed Consent Form by all subjects involved.

Steps for the implementation of the Program

Study of the territory and selection of participants

In common agreement with the Municipal Health Department (MHD) of the city of Natal, Rio Grande do Norte, two basic health units (BHU) were selected for the study because they are part of neighborhoods with the highest demographic densities, namely: Aparecida Family Health Unit (BHU 1) and Rocas Family Health Unit (BHU 2). Subsequently, the proposal was presented to the managers of each unit and then, the structuring schedule of the hearing loss identification and intervention program in the first years of life was organized together with the team, so as not to disrupt the routine of the service.

All CHWs of the selected BHUs were invited to participate in the study, a total of 34 CHWs. Of this total,

23 CHW accepted to participate, being 11 CHW from BHU 1 and 12 CHW from BHU 2, which constituted, therefore, the casuistry of the study.

Training course in Children's Hearing Health

The participating CHWs were instructed to carry out the training through the online course titled *"Actions in primary care for early identification of hearing impairment"*, available on the AVASUS platform. The training was proposed in different months for each BHU, and all had the option of performing it at home, at the BHU they work at, or in a space provided at the University with access to the internet at previously defined times, inserted in their work schedule, in common agreement with the BHU. Each CHW took the course individually and following their learning rhythm, but with a maximum limit of three weeks for completion.

The CHWs answered a questionnaire, applied in person by the researchers in two moments, before starting access to the platform and immediately after completing all the units of the course. The aforementioned questionnaire was previously validated and used in previous studies in order to evaluate the effectiveness of different training tools for this target audience[10-12]. It contains 20 questions divided into four domains: (1) conceptualization, (2) prevention, (3) identification and (4) general aspects. The answer options are "true", "false" and "I don't know", the latter having the role of minimizing the occurrence of random answers. For descriptive analysis of the data, the four proposed subject domains were maintained, and one point was assigned to each correct answer and zero points for the error or for the "I don't know" option, so the maximum score of the instrument was 20 points, which corresponded to 100%. The scores obtained were analyzed as a percentage.

Preparation of CHW for practical action in hearing health

After the training, the CHWs were guided, in person, by the researchers, on the actions to be developed to put into practice the learning obtained. For this, a printed infographic was used with a synthesis of the steps to be carried out: (1) identification of the number of children in their coverage area; (2) guidelines for pregnant women; (3) monthly application of a questionnaire to monitor the development of hearing and language of the child, with correct annotation of the information; and (4) referral of the child to specialized care in view of the needs found.

Indicators for analysis of the effectiveness of the proposed program

Child development monitoring

The follow-up of the child by the CHW began in the month following the end of the training. Therefore, the previously validated questionnaire was used to monitor hearing and language in the first year of life[15,18]. For each age there are two or three simple questions, with the answer options "yes" or "no", being the question "Does your child hear well?" common to all ages.

In view of the possibility of identifying hearing loss in the critical period of development, it was decided to use an additional questionnaire to expand the follow-up for children up to two years of age. As no previously validated instrument was found for the age group of 13 to 24 months, an additional questionnaire was developed for the present study. The development milestones were used as reference of the test Denver Developmental Screening Test (DDST), known as Denver II[19], and the scale ELM-Early Language Milestone Scale, developed by Coplan[20] adapted by Lima[21].

When identifying children whose parents or relatives reported complaints about hearing, or who reported delays in auditory or language behavior for two consecutive months, the CHW proceeded with the referral for child audiological evaluation in specialized care. The evaluation protocol involved the use of electro-acoustic, electrophysiological and behavioral procedures, directed by the *cross-check* principle[22], being used procedures applicable according to the age group.

Perception of the program by Community Health Workers

To verify the perception of the CHWs about the proposed model, all participants were asked, at the end of the research reference period, to present the positive and negative points of the implementation of the program for identification and intervention of hearing loss in the first years of life in primary care. The purpose of this request was to obtain an analysis of the satisfaction regarding learning and the difficulties and facilities in the execution of the monitoring of the child's hearing. Since these were subjective responses of the participants, the analysis of the responses was performed qualitatively by selecting expressions that

represented the most recurrent words in the participants' discourse.

Data analysis

The data were submitted to descriptive and inferential analysis. Initially, through the Shapiro Wilk test, it was found that the data did not follow the normal distribution. Thus, the Wilcoxon test for comparison of pre-and post-training performance and Mann Whitney test to compare the performance between the participants of the two BHU. The significance level equivalent to $p<0.05$ was adopted.

The analysis of the follow-up itself had as a reference the number of questionnaires applied according to the scope of the families accompanied by the professionals. To this end, a survey was conducted of the number of registered families that each CHW was responsible for in their microregion and the number of children from zero to two years old present in these families. The perception of the CHW about the proposed model was analyzed qualitatively.

RESULTS

The performance of CHWs in children's hearing health was portrayed in this study by including from the training stage, the follow-up of children with referral when necessary and the children's audiological evaluation itself.

Of the total number of CHWs invited to the two BHUs, 23 (63.9%) agreed to participate in the study. Of the 13 CHWs who refused to participate, three (21.4%) were from BHU 1 and eight (40.0%) from BHU 2. The reasons listed were: the high demand for activities (n=2), difficulties in informatics or using the internet (n=4), not having a computer and / or access to internet at home (n=3), the need to travel to the educational institution (n=2), not being interested in the topic addressed (n=3) and, still, other reasons, such as the course not being focused on adult hearing health (n=1).

Of the total of 23 participating CHWs, 21 (91.3%) completed the online course and two (8.7%) CHWs failed to finish in the study period. As the BHUs in which they operated did not have internet, six CHWs of the BHU 2 chose to carry out the training in their own home and all the others chose to use the infrastructure provided in the higher education institution in which the study was developed.

Participants complete the course within three weeks, with three-hour meetings twice a week. Among the six CHWs of the BHU 2 who chose to carry out the training at home, four completed the course in the same period and two did not complete all the units. The characterization of the participants in terms of gender, age and education is described in Table 1.

Table 1. Characterization of the community health workers participating

	BHU 1 n (%)	BHU 2 n (%)
Gender		
F	8 (72.2)	11 (91.7)
M	3 (27.3)	1 (8.3)
Age in years	Between 32 and 54	Between 31 and 59
Average	42.0	46.4
Schooling		
High school	7 (63.6)	7 (58.3)
Higher education	4 (36.4)	5 (41.7)

Captions: BHU = Basic Health Unit; n = absolute frequency; % = relative frequency; F = female; M = male.

Training course in Children's Hearing Health

In the comparative analysis of pre-and post-training performance, there were differences for the total score and for the domains, with the exception of only "general aspects" (Table 2). The descriptive statistics, considering mean, standard deviation, median and minimum and maximum values of the scores obtained are presented in Table 2.

Table 2. Pre-and post-training performance, in percentage of correct answers, for each domain and total score

Domains	Moment	Average	SD	Median	Minimum	Maximum	p
1. Conceptualization	Pre-training	40.28	18.65	32.32	16.66	83.30	0.000*
	Post-training	73.66	16.02	66.64	33.32	100.00	
2. Prevention	Pre-training	51.32	26.97	50.00	00.00	100.00	0.002*
	Post-training	86.84	15.29	100.00	50.00	100.00	
3. Identification	Pre-training	52.61	20.97	49.98	16.66	83.30	0.006*
	Post-training	72.78	12.68	66.64	49.98	100.00	
4. General Aspects	Pre-training	80.26	17.83	75.00	50.00	100.00	0.058
	Post-training	88.16	15.29	100.00	50.00	100.00	
Total score	Pre-training	54.21	12.94	55.00	30.00	80.00	0.000*
	Post-training	79.74	08.41	80.00	65.00	90.00	

*p < 0.05: statistically significant; Wilcoxon Test; SD= standard deviation.

When comparing the performance between the two BHUs, there was a difference in the pre-training moment for the "conceptualization" and "prevention" domains. However, such a difference was not maintained after the completion of the course. For "general aspects" and for the total score, there was a difference in the two evaluation moments, with better performance for the CHWs of the BHU 1 (Table 3).

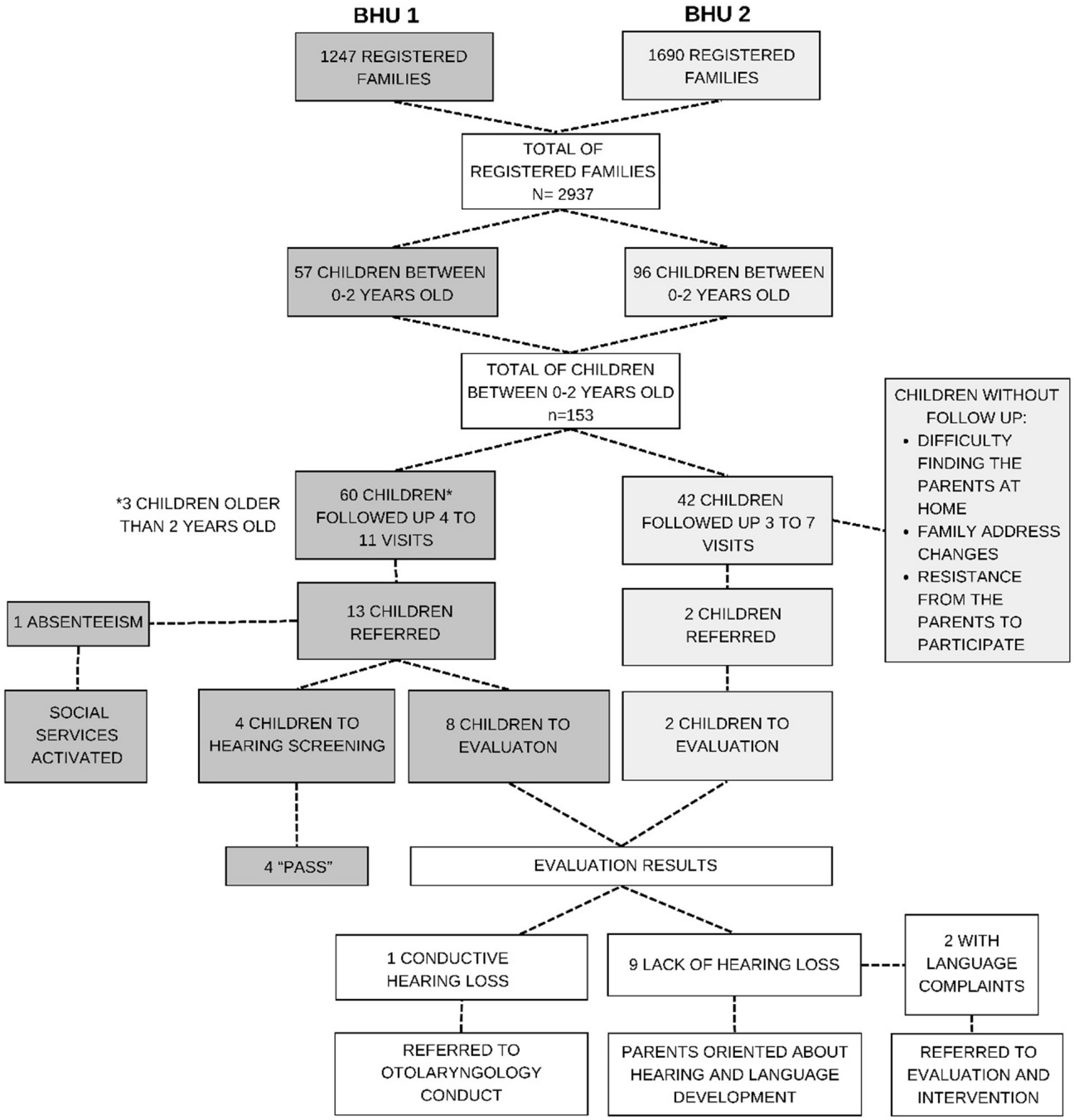
Table 3. Comparative analysis of pre-and post-training performance of basic health units, by domain and total score

Domains	Moment	BHU 1			BHU 2			p
		Median	Pct. 25	Pct. 75	Median	Pct. 25	Pct. 75	
1. Conceptualization	Pre-training	33.32	23.54	37.04	49.98	37.76	70.27	0.004*
	Post-training	83.30	68.63	88.90	66.64	53.75	79.53	0.103
2. Prevention	Pre-training	25.00	21.24	56.03	75.00	53.97	83.53	0.009*
	Post-training	100.00	82.44	99.38	75.00	66.47	96.03	0.207
3. Identification	Pre-training	49.98	35.75	61.18	66.64	38.61	78.01	0.207
	Post-training	83.30	69.69	84.80	66.64	56.11	77.17	0.088
4. General Aspects	Pre-training	100.00	77.09	100.00	75.00	59.07	78.43	0.012*
	Post-training	100.00	88.66	100.00	75.00	64.73	91.52	0.014*
Total score	Pre-training	45.00	41.46	56.72	60.00	51.07	71.43	0.035*
	Post-training	85.00	80.17	88.01	72.50	67.14	80.36	0.009*

*p < 0.05: statistically significant; *Mann-Whitney Test*
Captions: Pct.= percentile; BHU= Basic Health Unit.

Child development monitoring

After the training, the CHWs put into practice the knowledge obtained. The follow-up steps and the results obtained are represented in a flowchart (Figure 1). It is important to mention that, throughout the process, two CHWs from BHU 1 and three CHWs from BHU 2 did not continue to apply the questionnaires, with justifications related to the high demand of activities (n=3) and the fact that they changed roles or BHU, redirecting families from their coverage area to other CHWs (n=2).



Captions: BHU= Basic Health Unit; n= absolute number.

Figure 1. Flowchart of the follow-up steps of the two selected basic health units

Table 4 presents the characterization of the total of 15 children who were referred to the specialized care service, in terms of age, gender, Risk Indicators for Hearing Loss (RIHL) and the performance of NHS in the maternity of origin.

Table 4. Characterization of children referred by Community Health Workers for audiological evaluation

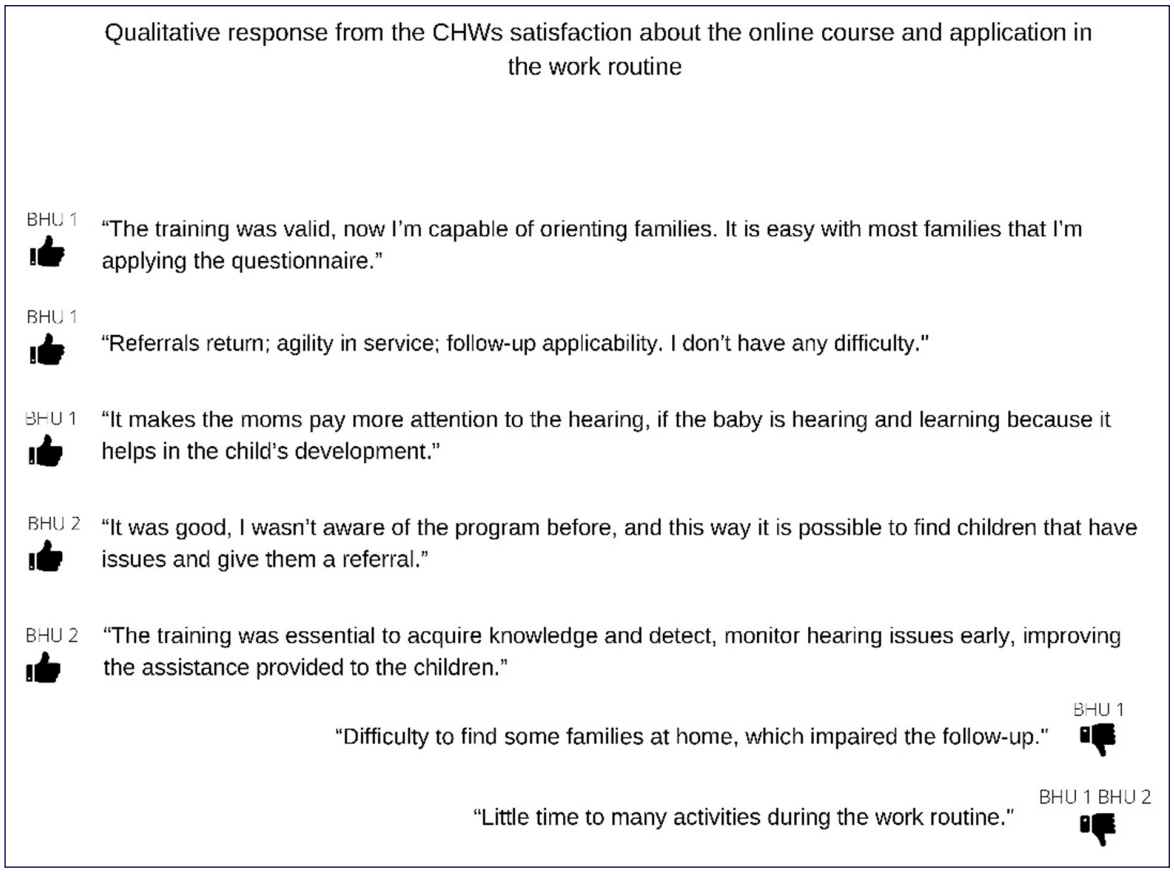
AGE	GENDER	RIHL	NHS
16 days	F	-	N
17 days	F	-	N
29 days	M	ICU; ECMO; ototoxic	N
30 days	M	-	N
38 days	M	-	N
51 days	F	-	N
53 days	F	-	N
53 days	M	ICU; ototoxic;	N
19 months	F	-	N
20 months	F	Congenital Syphilis, Hyperb; Ototoxic	Bilateral Pass
24 months	M	-	N
26 months	M	-	Bilateral Pass
36 months	M	-	Bilateral Pass
60 months	M	Ototoxic	Bilateral Pass
60 months	M	Heredity	N

Captions: RIHL= risk indicator for hearing loss; NHS= neonatal hearing screening; ICU= Neonatal Intensive Care Unit for more than five days; ECMO= extracorporeal membrane ventilation; Hyperb= hyperbilirubinemia; F= female; M= male; N= not performed.

Perception of the program by Community Health Workers

The CHWs, after seven to eight months of participation in the proposed program, reported the positive and negative points from training to the application of the acquired learning in their work routine.

Figure 2 shows examples of the most recurrent reports describing participants' satisfaction with the online training and the accompaniment of the children of the community. It is important to mention that the complaint regarding the short time for many activities was unanimous. The CHWs reported that they attached the questionnaire to the medical records of the families followed to maintain it as a monthly practice, even after the completion of the study, as directed.



Captions: CHWs = Community Health Workers; BHU = basic health units.

Figure 2. Perception of community health workers in relation to the implementation of the program for identification and intervention of hearing loss in the first years of life in primary care

DISCUSSION

The CHW was inserted in the Family Health Strategy (FHS) with the perspective of improving the health of the community, in view of the organization of primary care[1]. It is feasible that the performance of these professionals considerably increases the number of children who will be accompanied in their development regarding hearing, which strengthens the understanding that primary care should complement the NHS programs[4]. However, to achieve this objective, it is necessary that the professional is previously trained in the subject[2,11-17].

In the present study, the fact that most CHWs chose to take the course on the premises of the institution made it possible to verify the difficulties that these professionals present in the concepts of basic informatics. During the training, the difficulties presented with the digital tools were of different levels and demonstrated that it is really necessary to have prior training in computer science to enhance this initial stage of the program[12].

Another important aspect was the lack of internet in the BHUs, which hindered access in the work environment for training. According to the Internet Steering Committee in Brazil, there are an estimated 2,505 BHUs without access to computers and 3,397 without access to internet, predominantly located in municipalities in the Northeast region of the country[23].

The partnership with the University to carry out the study, obviously, will not be possible in all municipalities, which, at first, may allow us to question the viability of implementing this training in BHUs throughout the country. In this sense, progress is expected with the program "*Informatiza APS*" which is part of the digital health strategy of the Ministry of Health, with the proposal to support the computerization of health facilities and the qualification of Primary Health Care data throughout the country[24].

Thus, by ensuring basic computer knowledge and access to the necessary resources, knowledge about general aspects of hearing is configured as the first stage for the modification of professional posture and for

the advancement of activities aimed at hearing health in primary care. It is also highlighted the importance of the training courses being inserted in the workload of the CHW, to achieve a significant percentage of completion of the course, which, because it is online, requires greater determination and discipline from participants, including not to give up[13,14], which, despite being low, i.e., two CHWs of the total participants (8.6%), occurred in the present study.

Training course in Children's Hearing Health

The comparative analysis of pre-and post-training performance indicated an improvement in knowledge, which demonstrated that the online course was effective. This finding confirms the potential use of tele-education tools in the field of hearing health for these professionals[11-17] and encourages the expansion of a tool that mitigates the difficulties described above, with wide reach and free access throughout the national territory[14].

When considering the similar profile of the CHWs participating in the two BHUs regarding gender, age group and instructional level, it is possible to infer that the difference in performance may be associated with individual characteristics in relation to learning. It is important to mention that, despite the difference in performance, the CHWs of both BHUs obtained improved knowledge and were able to apply it in their daily work. Thus, the inequality in the level of prior knowledge did not make it impossible to take advantage of the course and, in addition, it covered some of these differences.

Child development monitoring

Initially, it was observed that, of the total of 153 children registered in the age group from 0 to two years, a coverage of 64% of follow-up was obtained. Considering that there was no action aimed at hearing health in these BHUs, prior to this study, it is considered a significant result. However, it is clear that coverage must be expanded. Given the difficulties listed by the CHWs, one aspect to be worked on is the awareness of families about the importance of monitoring the development of their children.

In the BHU 1, it was found that three children over the age group were included in the study by the CHW, upon complaints from families about hearing aspects. This conduct demonstrates that the CHWs understood the importance of auditory evaluation in children with family complaints regarding hearing and language development, which reinforces that the training carried out was effective.

Regarding the children referred to the specialized care service, only one child did not attend, and the Social Service was activated to carry out the active search. Therefore, the importance of multiprofessional articulation for the resolution of these situations found in the various stages of programs for identification and intervention of hearing loss in the first years of life is emphasized[25,26].

Of the children referred to the specialized service, only five had RIHL[27] and, only one of them initiated the monitoring of their hearing, as proposed by national and international guidelines[27]. This finding demonstrates yet another weakness of the programs for identification and intervention of hearing loss at the national level. It is important to emphasize that, although sensorineural hearing loss was not diagnosed in these children, one child with conductive hearing loss and two with language impairment were identified, which required evaluation and specific intervention. Thus, the presence of RIHL should not be a prerequisite for the performance of NHS and for the follow-up of children.

It is noteworthy that four children were referred by the CHWs, since the NHS registration in the maternity hospital of origin was not identified in the child's health record. This data reiterates the effectiveness of the course, since these CHWs understood the importance of early identification and treatment.

Additionally, this demonstrates that the performance of CHWs in hearing health is an important complementary strategy to the NHS, considering that, in the Brazilian reality, the estimated coverage is 39.7%[1]. Importantly, the goal of the Ministry of Health in NHS programs is 70% of live newborns[1], that is, universality will only be achieved with articulation with primary health care.

The current data demonstrate the feasibility of achieving this goal, considering the performance of the CHW. In Brazil, it is observed that the number of professionals in primary care is inversely proportional to the coverage of NHS programs[1,28,29]. In other words, in regions where NHS programs have less than 70% coverage, the rate of the population served by CHWs is higher than 80%.

It is noteworthy that, in the present study, there was 100% resolution, since the child with conductive hearing loss underwent surgery and, after reassessment, normal hearing was obtained. On the other hand, children with

complaints of language impairment were referred and cared for at the University. All family members were instructed in the development of hearing and language.

Perception of the program by Community Health Workers

In general, the CHWs were satisfied with their participation in the study, as can be seen in the representative reports presented.

However, important negative impressions were presented and should be considered to improve future implementations of this proposal. In this sense, the fundamental points would be: the reorganization of demands, the resoluteness of access barriers and the continuous incentive by managers for adherence to permanent education actions and practical action related to children's hearing health. It is also important to highlight the need to increase the number of CHWs, which is insufficient for the total population, given the difficulties and excess of activities to which they are subjected[30,31].

The present study showed, as a limitation, the use of the questionnaire between 13 and 24 months of age, which, although structured based on the development frameworks of standardized tests, had not been previously validated for application by the CHWs. However, this is an age group in which parents and guardians have high chances of identifying the main symptoms of disabling hearing loss. Identification by the parents themselves can occur accurately, especially if the child's hearing loss affects the frequencies of speech sounds and if it is, minimally, a moderate or bilateral hearing loss[32-36]. Similarly, for the first year of life, involvement, family observation and continuous monitoring are essential, given that, even with the use of a validated instrument, a sensitivity of 67% is estimated, with a false-negative rate of 33%, for not identifying unilateral hearing loss[18].

Another aspect that can be pointed out is the impossibility of comparative analysis of the results obtained in the follow-up of children between the units, due to the fact that the training was carried out in different months, that is, first in BHU 1 followed by BHU 2, with an impact on the shorter follow-up time and, consequently, on the number of visits and children followed up. Despite this, the results of this study showed that the performance of CHWs in a program of identification and intervention of hearing loss in the first years of life linked to primary care can increase the number of children accompanied or rescue those who evaded some follow-up, from the NHS stage to the intervention of children with hearing loss[6]. The questionnaire used for auditory monitoring is easy and quick to apply, making it feasible in the work routine of the CHW[16,17].

Therefore, when considering what was described above, this study brought representative data from a program model for the identification and intervention of hearing loss in the first years of life in coordination with primary care. It was possible to verify the feasibility of having effective training tools, available access resources, interest of managers and motivation of the CHWs themselves.

Thus, the action of the CHW can contribute to expand the identification, diagnosis and early intervention of hearing loss, and also to the rescue of families who may have evaded at some stage of the program of identification and intervention of hearing loss in the first years of life. A continuous improvement of public policies in hearing health is important for structuring a health care network and assistance can reach the entire population, with the expectation of minimizing inequality of access in the national territory[27,30,31].

CONCLUSION

The implementation of a program for the identification and intervention of hearing loss in the first years of life in primary care permeated by the intervention of CHWs was feasible and with promising results, however, strategies to minimize existing barriers should be adopted.

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