Effectiveness of an Ear and Hearing Care Training Program for Frontline Health Workers: A Before and After Study

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Abstract

Background: Delegating ear and hearing care (EHC) tasks to frontline health workers may help to improve much-needed access to this specialized care. Primary healthcare workers (PHCWs) need to acquire relevant knowledge and skill to recognize, refer, and/or treat simple ear problems. This study aims to evaluate the effectiveness of an EHC training program for PHCWs.

Methodology: The training intervention was a 2-day course based on an adapted WHO training resource in EHC for frontline workers. A pre and posttest study design was undertaken with the assessment of EHC at two time points using the same questionnaire at baseline and at completion of the training.

Results: One hundred and ninety PHCWs were recruited for the study. Overall, there was a statistically significant improvement from baseline to course completion. However, participants' scores in the domain of knowledge for risk factors were slightly low compared to other domains (54.3%, 95% confidence interval [CI]: 52.0%–56.6%), and this improved significantly following the training (72.7%, 95% CI: 71.0%–74.0%). A potential confounder in this evaluation may be that the scores recorded at pretest, which may change in the posttest due to regression to the mean phenomenon.

Conclusion: The findings from this study indicate that the training program demonstrated the potential to be an effective way to improve knowledge of EHC, and we suggest the inclusion of “primary ear care” as a component of primary health care.

Keywords: Ear care, effectiveness, health workers, task shifting, training

Résumé

Contexte: La délégation des tâches liées aux soins de l’oreille et de l’ouïe aux travailleurs de la santé de première ligne peut aider à améliorer l’accès indispensable à ces soins soins spécialisés. Les travailleurs de la santé primaire (SSP) doivent acquérir des connaissances et des compétences pertinentes pour reconnaître, aiguiller et/ou traiter les simples problèmes d’oreille. Cette étude vise à évaluer l’efficacité d’un programme de formation EHC pour les CSP. Méthodologie: L’intervention de formation était un cours de deux jours fondé sur une ressource de formation adaptée de l’OMS en EHC pour les travailleurs de première ligne. Un plan d’étude avant et après l’essai a été entrepris avec l’évaluation de EHC à deux moments à l’aide du même questionnaire au départ et à la fin de la formation. Résultats: Cent Quatre-vingt-dix CSP ont été recrutés pour l’étude. Dans l’ensemble, il y a eu une amélioration statistiquement significative entre le début et la fin du cours. Toutefois, les notes des participants dans le domaine de la connaissance des facteurs de risque étaient légèrement faibles comparativement aux autres domaines (54,3 %, confiance à 95 % intervalle [IC]: 52,0 % à 56,6 %), et cela s’est nettement amélioré après la formation (72,7 %, IC à 95 % : 71,0 % à 74,0 %). Un facteur de confusion potentiel dans cette évaluation peut être celle des scores enregistrés au stade pré-test, qui peut changer dans le post-test en raison de la régression au phénomène moyen. Conclusion: Les résultats de cette étude indiquent que le programme de formation a démontré le potentiel d’être un moyen efficace d’améliorer connaissance du CSM, et nous suggérons l’inclusion des soins de l’oreille primaire comme composante des soins de santé primaires.

Mots-clés: Soins de l’oreille, efficacité, travailleurs de la santé, transfert de tâches, formation

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Introduction

In sub-Saharan Africa, there is an overarching need for ear, nose, and throat specialists; one novel approach to cut down on the burden of disease and provide access to ear and hearing care (EHC) is by “task shifting.” Task shifting is a World Health Organization (WHO)-approved process of delegation, whereby tasks are moved to less specialized health workers to improve the coverage and efficient use of human resources. According to the WHO, task shifting “presents a viable solution for improving health-care coverage by making more efficient use of the human resources already available and by quickly increasing capacity, while training and retention programs are expanded.”[1,2] There is evidence that this can produce equivalent or superior outcomes for many diseases and health interventions including noncommunicable diseases,[3,4] such as hearing impairment.[5]

Hearing loss ranks as the third largest global contributor to the loss of healthy life due to disability and is one of only four nonfatal conditions among the leading 20 causes of the global burden of disease on the disability-adjusted life year index.[6] The global burden of diseases for hearing impairment is borne largely by low- and middle-income countries, affecting individuals, their families, and the community at large. Likewise, hearing impairment is often comorbid with communicable and noncommunicable diseases. The effects of hearing loss are far reaching, and apart from the negative consequences for socioemotional well-being and participation, it also results in severely restricted developmental outcomes for children and limited educational and vocational prospects for adults.[7] The WHO has suggested that community EHC should be approached at the community level in order to address ear diseases and hearing loss.[8]

Training lay frontline health workers from the community to deliver specialist activities in interventions has been proven to be successful.[9,10] Therefore, delegating EHC tasks to less specialized health workers is bound to improve the coverage and efficient use of our already overstretched human resources. In the field, frontline health workers also called primary health-care workers (PHCWs) are the appropriate staff necessary to integrate EHC into the primary health-care (PHC) system in our environment. Despite the intent to integrate primary EHC into PHC and establishment of a national ear care center for specialized/tertiary care, significant efforts for integration as a component of PHC have consistently failed in Nigeria, and there remains a nationwide treatment gap for primary ear and hearing health care.

In sub-Saharan Africa, there is limited or no access to hearing health-care professionals and necessary support;[11] this is particularly true in most rural communities in Nigeria. This not only predisposes patients to potentially life-threatening complications following ear infections but also could result in chronicity of ear diseases with consequent disabling hearing impairment. It was estimated that the prevalence of disabling hearing loss in Kano is 13.2%;[12] this high prevalence, especially at the primary care level, has major implications for the delivery of services to meet population needs in Northern Nigeria, particularly so in Kano State. The population of Kano State as at 2018 was approximately 13 million people (projected from 2006 census at an annual growth rate of 2.6%).[13]

If primary EHC is to be successfully integrated into PHC in low-income countries, then PHCWs need to acquire relevant knowledge and skill to recognize, refer, and support people with ear and hearing problems in their communities. To this end, the WHO has developed a training resource for use on a large scale for interactive and culturally appropriate training of frontline workers and also for more experienced personnel working at the primary level.[14]

Against this background, an intervention program was organized for PHCWs from across the PHCs in 44 local government area’s (LGAs) of Kano State utilizing a basic and adapted WHO resource material[15] by the researchers. Following a thorough literature search, there were no studies investigating the integration of EHC into PHC settings in Nigeria. Primary EHC training was delivered to PHCWs who had minimal or no knowledge about EHC, and the effectiveness of the training on their level of knowledge was evaluated. The hypothesis of the study was that PHCWs would demonstrate improved knowledge as assessed at completion of the intervention.

This article describes the conduct of the training and assessment of its immediate impact on the knowledge of PHCWs in Kano State.

Methodology

Study design

This study involved an evaluation of an EHC training program using a pre- and posttest design. The assessment of participants’ knowledge and attitude was undertaken at baseline and at completion of the course. The training and data collection were conducted between January and May 2016. Ethics approval was obtained from the Health Research and Ethics Committee of Aminu Kano Teaching Hospital and the Kano State Primary Health Care Management Board (KSPHCMB).

Participants and facilitators

Training participants were PHCWs sourced through KSPHCMB. The types of health workers included clinical assistant, health technologist, community health extension workers, community health officer, and community nurses.

The participants were trained in six separate groups of between 30 and 35 participants (total size 190) by the same facilitators who were specialist health professionals (otolaryngologists) with experience and understanding of community ear and hearing health.

The intervention

The EHC training program was a 2-day course aiming to increase early recognition of hearing impairment/ear...
diseases, identify red flags and referral, support clients with established hearing loss and their families, and improve ear hygiene promotion in their communities. The training was not intended as a training program for hearing health practitioners but rather as an introduction to EHC for the uninitiated PHCW. The training program was based on the WHO primary EHC (basic level) training resource,\[14\] which was adapted to suit local context by the study investigators. The content of the training program included an introduction/overview of EHC, detection of hearing loss in children/adults, identification and treatment of simple ear problems, first aid, EHC promotion, practice-based skills, and referral [Table 1]. The facilitator’s manual was designed to provide: (1) a plan for each training session including the purpose, timing, and required materials; (2) background information for each session; (3) a series of simple local examples that provide realistic scenarios describing people possibly experiencing ear problems/disorders; (4) suggestions for participatory activities and role-plays; and (5) pictures, posters, and ear models to assist in explaining concepts and frameworks.

**Questionnaire design and outcome measures**
Using a set of closed-ended questions, the same questionnaires were administered to the participants, before the training and at the end. The questionnaires had been pretested elsewhere prior to commencement of the training to ensure validity and standardization and to highlight possible problems. Responses to these questions and the options were precoded and therefore reported here. The questionnaires were self-administered and took about 20 min to complete. The questionnaire consisted of 20 questions, answered by either “yes,” “no,” or “do not know.” Correct responses were scored 1 and 0 for incorrect, do not know, or nil response. If a participant gave multiple answers for the same question, the question was left blank during data entry, based on the assumption that giving multiple answers to a question with only one correct answer proves a lack of correct knowledge. Participants who did not complete both points of measurement were omitted from the analysis.

**Sample size**
An initial sample size of 190 was chosen being the total number of participants trained over a 4-month period. Although three participants’ questionnaires were dropped, two for being incomplete and one for nonparticipation, therefore a total of 187 participants’ questionnaires were used for the analysis.

**Data analysis**
Statistical analysis was performed using Stata software version 15.0 (StataCorp, College Station, Texas, USA). All the scores were tested for normality using the Shapiro–Wilk test for the two points of measurement: baseline and postcourse. A paired t-test was used to determine the difference in the overall mean scores before and after the training. Similarly, a paired t-test was used to compare the mean score for knowledge regarding risk factors, hearing assessment, and ear and hearing protection at baseline and postcourse. For the analysis, alpha was set at 0.05.

### Table 1: Content of the ear and hearing health training program for primary health-care workers

| Module                                                                 | Topics                                                                 |
|-----------------------------------------------------------------------|-----------------------------------------------------------------------|
| 1. Introduction to ear and hearing health and disorders               | Common causes of hearing health and disorders                          |
|                                                                       | The effects of hearing loss                                            |
|                                                                       | Common predisposing/risk factors for hearing impairment/loss           |
| 2. Ear hygiene and first aid                                          | How to keep the ears clean                                             |
|                                                                       | Complaints of earwax and advices to give                              |
|                                                                       | Complaints of pain in the ear and first aid                           |
|                                                                       | How to prevent earwax children                                        |
|                                                                       | Noise as a hazard to the ear                                          |
|                                                                       | Otoxic medications                                                    |
| 3. Practice-based skills                                              | Detection and diagnosis of simple ear problems                         |
|                                                                       | Problem-solving techniques/use of the headlight                        |
|                                                                       | How to perform ear syringing                                           |
|                                                                       | How to dry mop the ear canal                                          |
|                                                                       | How and when to perform simple wick dressing using local materials    |
|                                                                       | Red flags and referrals to hearing health professionals              |
|                                                                       | Understanding simple topical drug treatments                          |
| 4. Ear and hearing health promotion and counseling                    | Introduction to ear care promotion                                     |
|                                                                       | Stigma and discrimination                                             |
|                                                                       | Personal hygiene and effects on ear infections                        |
|                                                                       | Introduction to counseling                                             |
|                                                                       | Harmful traditional practices                                          |
|                                                                       | Raising awareness in the community and in schools                     |

### Table 2: The sociodemographic characteristics of the participants

| Variable                  | Frequency (n=187), n (%) |
|---------------------------|-------------------------|
| Sex                       |                         |
| Male                      | 138 (73.8)              |
| Female                    | 49 (26.2)               |
| Age range (years)         |                         |
| 20-29                     | 29 (15.5)               |
| 30-39                     | 70 (37.4)               |
| 40-49                     | 73 (39.0)               |
| 50-59                     | 15 (8.0)                |
| Certification/qualification |                       |
| CHEW                      | 36 (19.3)               |
| CHO                       | 31 (16.6)               |
| JCHEW                     | 35 (18.7)               |
| RN                        | 7 (3.7)                 |
| SCHEW                     | 78 (41.7)               |
| Number of years worked as a PHCW |                 |
| 1-10                      | 74 (39.6)               |
| 11-20                     | 79 (42.2)               |
| 21-30                     | 30 (16.0)               |
| 31-40                     | 4 (2.1)                 |

CHEW=Community health extension worker, JCHEW=Junior community health extension worker, SCHEW=Senior community health extension worker, CHO=Community health officer, RN=Registered nurse, PHCW=Primary health-care workers
**Results**

**Participant characteristics**

There were a total of 187 (98.4%) participants who adequately completed the questionnaire at both points of the study. Table 2 presents the characteristics of the study participants. The mean age of participants was 38.4 years (±7.9 standard deviation [SD]), with a range of 21–57 years. The majority of participants were male 138 (73.8%), whereas females accounted for 49 (26.2%), with a male: female ratio of 2.8:1. The duration of experience of the PHCW ranged from 1 to 34 years, with a mean of 13.6 years (±8.1 SD). The highest number of PHCW was the senior community health extension worker (41.7%). Majority of the PHCW had experience of community health work for at least 11–20 years (42.2%).

**Test of normality and main effects**

Results from the Shapiro–Wilks test for both pre- and posttest scores were not significant, indicating that the scores were normally distributed (P = 0.44 and 0.06, respectively). Therefore, a paired t-test was chosen for the data analysis. The outcome of the study was that PHCWs demonstrated improved knowledge as assessed at completion of the training. This was clearly shown by a low P value (P < 0.05) overall and for the three main domains of assessment [Table 3].

Regarding pretest questionnaire on knowledge of risk factors, the participants scored slightly low (54.3%, 95% confidence interval [CI]: 52.0%–56.6%), but this improved significantly following the training (72.7%, 95% CI: 71.0%–74.0%) [Table 3], showing a statistically significant improvement from baseline (P < 0.001).

The majority of the PHCWs (65%) said that the length of the training was right, whereas 35% thought that it was too short. Regarding skills for referral and identifying red flags, 85% reported that they felt comfortable, whereas 15% felt very comfortable after the training. None of the PHCWs reported feeling otherwise. There was an expressed need to scale-up the training in subsequent years.

**Discussion**

Ear and hearing problems can cause life-long difficulties with education and employment. To this end, the training of PHCWs in low-income countries through task shifting especially is a major source of interest to many working in the field of global hearing health. This study makes an important contribution to the related literature by conducting an evaluation of a training program for PHCW in rural Nigeria, using an adapted but basic WHO training resource material. Although the number of PHCWs trained relative to each PHC was small, the outcomes have been encouraging with a view to scaling up the training over time.

These findings suggest that the EHC training program has been a success. Due to the enthusiasm, some participants have suggested that the training should be conducted at least twice per year despite being overworked and overburdened with competing tasks. Although this may not be unrelated to promise of transport reimbursement to CHW as an added motivation to participate in the program. Studies have shown that a mix of financial and nonfinancial incentives is an effective strategy to enhance performance, especially for community health workers (CHWs) with multiple tasks. Despite the extensive travel and the considerable demands of participants’ daily working and living duties, we recorded full attendance at all times. Assumingly, this may be because the training was the first of its kind and the need was especially high in Kano where the skills to tackle these EHC problems are generally lacking. Moreover, estimates also indicate a high prevalence of hearing impairment in middle- and low-income countries, demonstrating the global need for attention to hearing impairment.

The training increased the ability of the PHCWs to recognize risk factors for ear diseases and hearing impairment, discourage the use of incorrect pharmacological agents, and create awareness about some harmful cultural practices. The effectiveness and feasibility of such a training or intervention has also been reported by several studies.

The performance overall was impressive; however, we cannot eliminate self-learning, especially when participants go back with training materials overnight; this further exemplifies the effect of temporal changes in before and after studies such as this. The slightly low performance in the risk factor domain is not unusual since EHC is not in the curriculum of this level of training in our environment, but we assume common sense prevailed to account for the fair performance [Table 3].

| Table 3: Summary of overall pre- and posttest scores (n=187) |
|-----------------|-----------------|-------------|-------------|------------|------|
| **Variable**    | **Test**        | **Mean (%)**| **SD**      | **95% CI** | **P** |
| Overall scores  | Pretest         | 64          | 12.1        | 62.0–65.5  | <0.001|
|                 | Posttest        | 79          | 10.5        | 77.5–80.5  | <0.001|
| Knowledge on risk factors | Pretest | 54.3      | 16.0        | 52.0–56.6  | <0.001|
|                 | Posttest        | 72.7        | 10.6        | 71.0–74.0  | 0.002 |
| Knowledge on hearing assessment | Pretest | 79.1      | 15.8        | 76.9–81.4  | 0.001 |
|                 | Posttest        | 87.4        | 18.2        | 84.8–90.1  |      |
| Knowledge on hearing and ear protection | Pretest | 68.3      | 21.7        | 65.1–75.4  | 0.001|
|                 | Posttest        | 84.1        | 15.4        | 81.9–86.4  |      |

SD=Standard deviation, CI=Confidence interval
Similarly, another confounder of interest is that the scores recorded at pretest may change in the posttest because of regression to the mean and not necessarily due to the training intervention. However one thing is clear, physical presence combined with audiovisual contents was paramount to the overall performance of participants; this was also reported by another study looking at effectiveness of videoconferencing as a training method.\[22\]

The participants also performed well regarding assessment of hearing loss [Table 3]; this buttresses the fact that PHCWs, as part of efforts to increase access to audiological services in rural communities, can be trained appropriately, which is in line with the suggestion by Sánchez et al., regarding application of the CHW model with partnership of audiologists to render services in underserved areas.\[10\]

This study showed that training PHCWs can be a valuable source for providing much-needed access to EHC at the rural level. This is similar to a recent study from Malawi,\[9\] using a cluster randomized controlled trial; the researchers reported that training was effective in improving the knowledge of CHWs in EHC in Malawi. The high prevalence of ear diseases and hearing loss in sub-Saharan Africa is at least partly due to the severe shortage of health workers,\[23\] for which trainings such as this could potentially close some gaps for this unmet need area.

Furthermore, researches aimed at evaluating the performance of CHWs looking at various other tasks have also reported results consistent with our study.\[20,24-26\] In a similar study in Bangladesh, it was reported that integration of the treatment of severe acute malnutrition into community-based health and nutrition programs was feasible and effective.\[27\]

**Strength of study**

The analysis was based on a simple but structured methodological approach not frequently utilized to assess interventions for training PHCWs regarding primary EHC in our environment. This is also due to its low cost, convenience, and simplicity as well as utilizing the ability of a pre- and posttest design to overcome ethical concerns which are common with randomized designs. Similarly, the entire training was coordinated and executed by an otolaryngologist with experience in community EHC and also drew on tools prepared by the WHO.

**Limitations**

There are several limitations to this study, including the lack of a control group. Without a control group, it is difficult to establish a cause and effect relationship. We believe that this pretest and posttest design was appropriate for this evaluation study, and we acknowledge that further research in this area is required using a randomized controlled trial design with a control group. The lack of a focus group discussion could have helped to assess attitudinal change and/or qualitative aspects of the training.

The long-term impact of the training on the self-confidence of the PHCWs, subsequent hearing health consultations and referrals, and benefits for people experiencing ear and hearing problems including improvements in pathways to treatment and recovery remain unknown largely due to lack of reliable data and/or inadequate funding. Similarly, the definition and job description of PHCWs is different in many countries; therefore, the generalization of these findings to other settings must be done with caution.

**Future research**

Further research is required in the area of primary EHC, such as the feasibility of a cost-effective, tailored-made training for our environment as well as a cluster randomized controlled trial among different cohorts of CHWs. This could be trialed in many countries across sub-Saharan Africa as well, where the burden of hearing loss is equally huge.

**Conclusion**

This study shows that training PHCWs for EHC in our communities can be effective. Although the number of PHCWs who were trained may have been small considering the population they serve, overall findings from this study are encouraging as it can be scaled up with availability of more funding. Similarly, the expected outcomes for this training program were largely met, i.e., to improve PHCW recognition and treatment of simple ear disorders, reduce complication rates from ear diseases through early recognition and referral, and improve PHCW recognition of the link between unsafe ear practices, ear disorders, and hearing impairment. We, therefore, posit that designing a comprehensive package for primary EHC inclusive of community awareness programs and full integration of EHC, as a component of PHC, is a laudable goal.

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**Conflicts of interest**

There are no conflicts of interest.

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