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Training, supervision, and performance of Community Health Workers in the delivery of ear and hearing care to 321 community members in rural Uganda

Running title: The delivery of ear care by CHWs in Uganda

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Abstract

Objectives

Community Health Workers are one way to address the shortage of ear and hearing care specialists in low resource settings. However, there are few reports evaluating training and service delivery by Community Health Workers.

Design, Setting and Participants

We trained 13 Community Health Workers in primary ear and hearing care in Mukono District, Uganda. Community Health Workers attended a two-day training workshop and received remote supervision thereafter during service delivery in the community. An ear camp was held at the local health centre every two months, where a local ENT specialist could assess referred cases.

Main outcome measures

Clinical and diagnostic skills and decision making were assessed using an Objective Structured Clinical Examination, with scores recorded at baseline and six months. Service delivery was evaluated by analysing: (i) number of individuals evaluated; (ii) treatments delivered; (iii) cases referred for specialist opinion; (iv) proportion of appropriately referred cases; (v) agreement between Community Health Worker and specialist diagnosis.

Results

Observed Structured Clinical Examination scores were high and stable for six months. 312 individuals were screened in the community by the Community Health Workers, with 298 classified as having an abnormality. Care was delivered in the community to 167 of these, and the remaining 131 referred to the ear camp. Diagnostic agreement was 39%, but 98% of referrals were deemed “appropriate” by the ENT specialist. 27 individuals self-presented to the ear camp without prior assessment by a Community Health Worker, and 97% of these were deemed appropriate.

Conclusion

Trained Community Health Workers can play an important role in delivering ear and hearing services. Future work should look to explore this model in other contexts and/or compare to other models of service delivery.

Key points

- Community Health Workers have been proposed as one way to address the shortage of ear care professionals in low- and middle-income countries.
- There is a paucity of existing literature outlining and evaluating training programmes for Community Health Workers to deliver primary ear care services.
- We found Community Health Workers were able to acquire and maintain skills in clinical assessment (otoscopy and whispered voice test of hearing); ear treatment (ear washout, wicking, and instillation of drops); and case management over a six-month period.
- Community Health Workers were able to accurately identify cases of ear disease and hearing loss in the community, and arrange onward referral to an ENT specialist.
- Community Health Workers could potentially play an important role in improving ear and hearing services in low- and middle-income countries, however, appropriate parallel investment needs to be made in specialist ear care services in low resource settings to support their work.

Keywords: Community Health Worker; hearing; audiology; otology; ear disease; hearing screening; training; supervision.

Introduction

The global burden of hearing loss is estimated at \$750 million annually, with up to 73% of these costs, and the majority of the affected population, living in low- or middle-income countries (1). A shortage of trained ear and hearing specialists in low- or middle-income countries hampers delivery of programs to counter this issue (2-4) and may necessitate alternative models of service delivery (5) including “task shifting” (redistribution of tasks from specialists to workers with fewer qualifications and less training (6)) or “task sharing” (collaboration between healthcare workers, and simultaneous upskilling of alternative cadres of healthcare workers (7)). Task shifting or sharing with Community Health Workers has the potential to reduce cost of care, increase access to health services in remote regions, and improve disease outcomes (7). A recent review found that although Community Health Workers can successfully screen for ear and hearing disorders, and have a potential role in diagnosis and management (8), there is a paucity of studies describing or evaluating training of Community Health Workers in this role, or measuring their clinical performance (8).

Here we sought to address this knowledge gap through the design and evaluation of a training and supervision programme for Community Health Workers to deliver primary ear care in rural Uganda.

Methods

Ethics

Approval was granted by research ethics committees at Mengo Hospital Research Ethics Committee (114/07-18), Ugandan National Council for Science and Technology (SS 4723), and The Department of Education Research and Ethics Committee (DREC) at the University of Oxford (ED-CIA-18-218). All participants gave written informed consent.

Setting & Participants

The study took place from January to July 2019 in Seeta Nazigo Parish, Mukono District, Central Uganda: a region of 15,000 residents, predominantly working as subsistence farmers (9). The parish has one government non-specialist health centre, with the ENT centre 35 kilometres away at Mulago National Referral Hospital, Kampala.

We purposively selected and invited 13 volunteer government-affiliated Community Health Workers from four villages in Seeta Nazigo Parish to participate. No Community Health Worker had prior training in ear or hearing care.

Model of training and supervision

Initial training comprised a two-day workshop held at the local health centre in January 2019, delivered by two Ugandan ENT surgeons assisted by two doctors from the UK and Australia. The non-Ugandan doctors were supported by two research assistants to translate from English to Luganda. Training was based on the WHO Primary Ear Care Manual (10), with content updated, adapted and selected to local needs. A translated copy of the manual was provided to each Community Health Worker.

The workshop included interactive lectures covering basic anatomy, pathophysiology, and management of ear and hearing disorders, supplemented with teaching on practical skills (history

taking, otoscopy, whisper test of hearing, ear washout, dry mopping, instillation of ear drops), using bespoke video demonstrations, live instructor demonstration, and trainee rehearsal.

Shortly after initial training Community Health Workers began to assess and manage ear and hearing disorders in the community, with ongoing supervision and training delivered in a blended fashion through both in-person and digital formats. Each Community Health Worker was supplied with an iTEL A20 smartphone (Itel Mobile, Shenzhen), a data bundle, access to a WhatsApp platform (Facebook Menlo Park), and a portable solar powered battery charger. Community Health Workers were divided into two groups (based on village of residence), with a peer-supervisor for each group elected by the Community Health Workers. Peer-supervisors received training from the project lead in how to facilitate supervision, and were tasked with accompanying Community Health Workers on home visits and providing pastoral support. No fixed schedule was stipulated, but supervisors were encouraged to contact Community Health Workers at least monthly to offer a scheduled joint home visit. The project lead (a non-specialist doctor) and the two research assistants facilitated technical or clinical queries raised by peer-supervisors or Community Health Workers. Where they felt unable to answer clinical queries (e.g. interpretation of a complex otoscopic image), information was forwarded for opinion from an ENT specialist.

Ongoing training was also provided through a WhatsApp group which included all 13 Community Health Workers, and project facilitators to moderate discussion. Clinical cases were released to this forum bi-monthly, typically on a Monday, with discussion over the subsequent three to four days. The first two cases were pre-determined, with subsequent cases selected by Community Health Workers based upon common conditions or scenarios encountered in their daily practice. Each case was checked for clinical accuracy by an ENT specialist prior to release, and contained structured questions on diagnosis and management, often with an accompanying clinical image. Participation was voluntary and open (meaning participants could see all responses).

Evaluation of training and supervision

We assessed outcomes of training and supervision after completion of initial training and six months later.

We tested Community Health Worker skills using a novel bespoke Objective Structured Clinical Examination delivered the day after completion of initial training. This comprised three stations testing clinical assessment (otoscopy, whispered voice test of hearing), ear treatment (ear washout, wicking, instillation of drops), and case management (five cases with discussion on diagnosis and management). Each station was allocated 20 minutes and 20 marks (60 marks total) and was examined by an ENT specialist (assisted by a Luganda translator where required) using a structured marking scheme. At six months we re-evaluated skills by repeating the Observed Structured Clinical Examination using the same stations and metrics. We compared initial and six-month scores using a Wilcoxon Rank Sum test. At six months we also recorded the number of Community Health Workers who had engaged with each case discussion on the WhatsApp forum.

Model of service delivery

Each Community Health Worker was provided with proformas to record clinical findings, an Arclight otoscope (Arclight Medical, Liverpool), speculae, chlorhexidine wipes, a dispensing bottle of olive oil, disposable 20ml syringes, sterile water, iodine solution, gloves, tissue paper, kidney dishes, and a backpack. Community Health Workers screened individuals in their jurisdiction identified by the head of household to have, or have had, ear or hearing symptoms (e.g. ear discharge or pain). All individuals were assessed through clinical history, otoscopic examination, and a whispered hearing test. All assessment and treatment was free of charge. Prior to the Community Health Workers being trained for this study, no specific primary ear care services were available in Mukono District.

If a Community Health Worker found active ear infection they could refer the patient to the local health centre for assessment by a non-specialist clinical officer and treatment with antibiotic drops. In cases where Community Health Workers felt unable to reach a definitive diagnosis or management plan, they recorded a presumptive diagnosis and referred to an ear camp for specialist opinion (many community members were reluctant to attend the regional hospital due to a lack of transportation, negative past experiences, and/or inability to pay).

Three specialist ear camps were held at the local health centre in March, May and June 2019, and advertised by loudspeaker in villages on the day preceding the camp. Camps were led by a Ugandan ENT specialist who could undertake diagnosis and offer medical management, or where indicated, refer onwards for assessment or treatment at the regional hospital (for example due to a lack of appropriate expertise or equipment in the camp setting). Community members were also able to self-refer to the camp without having previously seen a Community Health Worker. To ensure equity, all patients were assessed at the camp regardless of how they got there.

Evaluation of service delivery

We measured Community Health Worker performance by recording the number of individuals assessed, their diagnosis, treatments delivered in community, and the number of cases referred to the specialist ear camp. For individuals referred to the ear camp we recorded concordance between the ENT specialist and Community Health Worker diagnosis (complete agreement when all aspects of diagnosis matched, partial agreement when main diagnosis matched but some details missing or discordant), and the proportion deemed by the ENT specialist to be an appropriate referral. We also recorded diagnosis in community members self-referring to the ear camp, and the proportion judged by the specialist to be appropriate for this service.

Results

Training and supervision

Demographics of participating Community Health Workers are summarised in Table 1. Mean Observed Structured Clinical Examination scores across all domains were high after initial training, with no evidence of decline at six months (Table 2). In disaggregated individual data (not shown), total Observed Structured Clinical Examination score was higher at six months compared to initial assessment for all Community Health Workers except one. Over the six-month period, nine structured case discussions were shared on the WhatsApp platform, with high rates of participation for the first six (Table 3).

Service delivery

Over six months a mean of 24 (range 6-77) community members were assessed by each Community Health Worker (Figure 1), totalling 312 individuals. Of these 298 ($298/312 = 96\%$) were classified as having an abnormality. Care was delivered in the community to 167 of these ($167/298 = 56\%$), and the remaining 131 ($131/298 = 42\%$) were referred to an ear-camp. For individuals treated in the community, the most common abnormality recorded was ear wax ($150/167 = 90\%$), managed through application of olive oil and/or ear syringing, with no complications reported. The remaining 17 cases ($17/167, 10\%$) were individuals with Chronic Suppurative Otitis Media (CSOM) and were managed either conservatively, or referred to the local health centre for topical antibiotics.

51 ($51/131, 39\%$) of the 131 individuals referred by Community Health Workers attended one of the three ear camps. In these individuals there was complete agreement on diagnosis between Community Health Worker and specialist in 20 cases ($20/51 = 39\%$), partial agreement in 9 ($9/51 = 17\%$) and no agreement in 22 ($22/51 = 43\%$). 50 referrals ($50/51 = 98\%$) were deemed appropriate for ENT opinion by the specialist.

A further 27 individuals self-presented to ear camps having heard about the service, but without previous assessment by a Community Health Worker. Of these 26 ($26/27 = 97\%$) were deemed appropriate by the specialist. There was no difference in “appropriateness” of individuals self-referring versus those referred by Community Health Workers ($50/51$ vs $26/27$, Fishers exact test, $p=1$).

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Amongst all individuals attending the ear camp, the most common diagnoses were impacted wax (21/78 = 27%), CSOM (20/78 = 26%), otitis externa (13/78 = 17%), or hearing loss (14/78 = 18%), with no evident difference in pathology in individuals referred by Community Health Workers versus those self-presenting. 41 (41/77 = 53%) individuals were treated on site by the specialist, with the remainder referred to the regional hospital.

Discussion

This is one of the first studies to detail and evaluate a training, supervision and service programme for Community Health Workers in primary ear and hearing care. Our data suggests this model is feasible and provides relevant metrics for those considering similar or alternate programs in other settings.

A pre-requisite for delivery of a high-quality service is an adequately trained workforce. The majority of prior studies on training Community Health Workers in ear and hearing care have evidenced learning through performance on a multiple-choice questionnaire (MCQ) (8), but here we used an Observed Structured Clinical Examination assessment comprising three stations evaluating clinical assessment, management, and specific treatments. All Community Health Workers performed well. This experience, and that from other contexts (11), suggests that Observed Structured Clinical Examinations should replace or supplement MCQs in evaluating acquisition of clinically relevant skills and knowledge in ear and hearing care.

Our approach also included a mechanism for ongoing support and supervision, which is important for Community Health Worker performance (12) but often overlooked (13). For example, a study in Brazil involving 24 Community Health Workers trained in prevention and rehabilitation of hearing loss but not provided with ongoing educational support, found poor knowledge retention 15 months later (14). Here we used a WhatsApp platform to facilitate remote, continuous, real-time support, peer-to-peer exchanges and communal learning, with success evidenced by maintained Community Health Worker Observed Structured Clinical Examination scores six months after training, and high participation in case discussions. However, one of the potential limitations of this approach is the low engagement with the structured WhatsApp case during month six (July 2019), given that only five of the thirteen Community Health Workers responded to the final case. Yet, despite this initially concerning figure, informal feedback on decreased participation in case discussions towards the end of the six months revealed that non-participating Community Health Workers had in-fact viewed latter cases, but chose not to engage as they agreed with opinions their peers had already provided. This suggests that for online supervision platforms, quantitative measures alone (e.g. the number of Community Health Workers responding to a case) may not give a true and accurate representation of actual engagement with a

case, since some learners may engage passively. Smartphone ownership and use of WhatsApp is increasing in low resource settings (15-18), which holds promise for expansion of technology-assisted approaches to train and supervise Community Health Workers (19).

Previous studies of Community Health Workers involvement in ear and hearing care have either explored a rather circumscribed role (such as solely screening for hearing loss), or described training in the more comprehensive model envisioned in the WHO primary ear and hearing care training manuals, but then failed to adequately detail outcomes (8). Our study is therefore the first to report data on Community Health Worker led assessment and management of ear and hearing disorders. Because we are confident that our Community Health Workers had the requisite training and educational support, our data likely represent the upper end of what can be achieved through this model. The outcomes are largely encouraging. In individuals identified with pathology, Community Health Workers successfully managed over half in the community, and of the 58 referred to ear camps, almost all were deemed appropriate for referral by the specialist. There was however considerable disagreement in diagnosis between Community Health Workers and specialists amongst referred cases. It is important to remember that the Community Health Workers were using an otoscope with poorer optics than that used by the specialist, and that diagnostic accuracy was only evaluated in cases referred by a Community Health Worker because of uncertainty in diagnosis or management. This may have falsely decreased diagnostic agreement, although other studies have also reported poor concordance in diagnosis between specialist and non-specialist workers in ear and hearing care (20, 21).

Overall, our data suggest Community Health Workers can assess, manage and appropriately refer many disorders of ear and hearing in the community, and so reduce burden on ENT specialists. With further training, equipment (such as audiometers), or access (such as antibiotic prescribing rights), Community Health Workers could take on an even greater role.

It is also important to recognise alternatives to Community Health Worker models of service delivery. Here almost all the 27 individuals who self-referred to the camp were deemed appropriate, and so a model of self-referral to a local specialist ear camps could be preferable to the Community Health Worker model. Future work could look to formally compare these models

for delivery of community ear and hearing care, measuring outcomes of accessibility, acceptability, feasibility, coverage, performance, and cost.

Limitations

Our sample of Community Health Workers, their equipment, their access to specialist training, assessment and support, and the characteristics of the population served, mean that the findings from our study may not be fully generalisable to other settings. Resource limitations meant we were unable to evaluate diagnostic accuracy and management of individuals assessed in community by Community Health Workers and not referred to ear camps, nor follow up the 80 individuals referred to the ear camp by Community Health Workers who failed to attend (*N.B. comparable studies in Malawi and Uganda report cost and distance as potential obstacles to attendance* (22, 23)). It is important that patient referrals to ear camps are done correctly, but it is even more important to know if those who are not referred do not really need it. Future work should therefore aim to capture these metrics, which our work failed to do. We are also uncertain of the sustainability of this model beyond our six-month evaluation, although this is something we continue to monitor. It is also important to note the difference in the number of individuals evaluated by each Community Health Worker (ranging from 6 to 77). The success of such a model relies on Community Health Workers screening an appropriate number of individuals in the community, and so understanding the reasons for individual Community Health Worker variability in terms of number of individuals screened will be important to ascertain in future larger scale studies. One reason for this could be due to individual Community Health Worker motivation. Obtaining self-reported motivation scores and correlating these with the number of patients reviewed and assessed in the community would be an interesting outcome in a future study. Finally, the use of the same Observed Structured Clinical Examination assessment stations at baseline and month six may have introduced an element of bias, however we elected to use the same stations in order to carry out a direct comparison of assessment scores.

Conclusion

A well trained and supported cadre of Community Health Workers can evaluate and manage ear and hearing disorders in the community, and our model may be one that others can emulate.

Future work should look to directly compare the Community Health Worker model to alternative service delivery models for overcoming human resource limitations in ear and hearing care.

Data sharing: Anonymised data available upon request.

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Tables:

Sex (M:F)	Age (mean; $\pm$ S.D; range)	Years of Education (mean; $\pm$ S.D; range)	Years served as a Community Health Worker (mean; $\pm$ S.D; range)	Number of households served (mean; $\pm$ S.D; range)	Number of household visits in month prior to recruitment in study (mean; $\pm$ S.D; range)
5:8	44.9; $\pm$ 9.1 ; 36)	10.8; $\pm$ 2.2; 5	8.6; $\pm$ 1.1; 4	61.1; $\pm$ 33.4; 92	14.2; $\pm$ 26.9; 100

Table 1. Community Health Worker demographics and characteristics. Demographic details and characteristics of the Community Health Workers involved in the study (n=13).

Observed Structured Clinical Examination station	Subset skill	Score after initial training mean $\pm$ SD (range)	Score six months after training mean $\pm$ SD (range)	Difference in scores (Wilcoxon rank sum test)
Ear Examination	Otoscopy (maximum score 10)	8.6 $\pm$ 1.2 (4)	9.3 $\pm$ 1.0 (3)	p=0.10
	Whisper hearing test (maximum score 10)	9.1 $\pm$ 0.9 (2)	9.5 $\pm$ 0.9 (3)	p=0.15
Ear Treatment	Ear washout and dry mopping (maximum score 10)	9.2 $\pm$ 1.1 (4)	9.5 $\pm$ 0.8 (2)	p=0.65
	Instillation of antibiotic drops (maximum score 10)	6.7 $\pm$ 1.1 (4)	8.2 $\pm$ 1.5 (5)	p=0.01

Case Assessment (maximum score 20)	16.5 +/- 1.34 (5)	16.6 +/- 1.7 (6)	p=0.79
Total	50.2 +/- 2.5 (9)	53.1 +/- 3.8 (15)	p=0.01

Table 2. Observed Structured Clinical Examination scores. Observed Structured Clinical Examination scores after initial training and at six months.

Case Discussion	Month	Topic	Rationale for inclusion	Number (%) of Community Health Workers responding
1	February	CSOM	Core case	12 (92%)
2	February	Cholesteatoma	Core case	11 (85%)
3	March	Impacted ear wax	Common condition in community	13 (100%)
4	March	Hearing loss	Request from Community Health Workers	13 (100%)
5	April	Itching ears	Common condition in community	13 (100%)
6	April	Photo cases (post-auricular)	Cases seen in	12 (92%)

		fistula, otitis externa, microtia and skin tags, pre-auricular sinus)	community	
7	May	Acute Otitis Media	Core case	10 (77%)
8	May	Mastoiditis	Core case	10 (77%)
9	July	Fungal ear infection	Cases seen in community	5 (38%)

Table 3. WhatsApp group discussion. Cases discussed and number of Community Health Workers responding to each case.

Figure legends

Figure 1. A COMMUNITY HEALTH WORKER on a home visit and observed by their peer-supervisor. (A) Explaining the project to a community member; (B) Obtaining consent with a thumbprint on consent forms in English and Luganda; (C) Taking a history from the community member; (D) Performing otoscopy; (E) Performing a whispered hearing test; (F) Instructing a family member how to administer olive oil drops for impacted wax.



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