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Assessment of the Readiness of Community Health Workers to Participate in a Mobile Training and Support Services Innovation: Results of a Functionality Assessment in Bo District, Sierra Leone 2018

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Abstract

Background: Mobile Training and Support (MOTS) service is the vehicle for delivery of refresher training on healthcare related topics. This service will provide mobile training to Community Health Workers (CHWs) *via* their mobile phones with feature phones as the basic requirement. The MOTS service will provide training modules *via* Interactive Voice Response (IVR) or voice messages that include units and quizzes and allow monitoring by management. The purpose of the study was to assess the functionality of CHWs and their readiness to receive the MOTS service package.

Method and Material: The study was a cross-sectional assessment utilizing both quantitative and qualitative data collection methods in Bo district, southern Sierra Leone found in West Africa. The tools had mixed method questions to capture both quantitative and qualitative data.

Results: The CHWs' willingness to participate in the MOTS service was 99.2% with 79.2% mobile phone functionality. This therefore meant that 79.2% of all CHWs surveyed met the inclusion criteria for the MOTS program. With 90.6% of the Peripheral Health Unit (PHU) in-charges proving to be supervising CHWs, only 40.63% of the PHU in-charges could actually provide supervision to CHWs for the MOTS program due to the need to own a smartphone.

Conclusions: Utilization of the modular IVRs through the MOTS service to facilitate the refresher training to CHWs is possible. This is because from the assessment 79.2% CHWs met the inclusion criteria for MOTS. At the CHW level, the willingness to participate was rated at 99%. This coupled with a 90.6% of PHU-Incharges readiness will contribute to the success of the program.

Keywords: Community health worker; Mobile training and support service; Community health worker functionality; Community system readiness; Community health worker training

Introduction

The CHW policy guidance in Sierra Leone

When Sierra Leone faced the Ebola virus disease outbreak, the country fought hard and made tremendous progress within a short space of time to recover the healthcare system and restore essential healthcare services. CHWs were acknowledged to be part of this not as a business but as usual approach [1]. CHWs, many of whom had been working within their communities for years, stepped up to meet the enormous challenge and acted as contact tracers and members of burial teams, and helped to spread messages of caution and hope to their communities [2].

The President's Recovery Priorities [3] set ambitious targets for the country, including saving the lives of 600 women and 5,000 children by 2018, as outlined in Key Result Area 1, strengthening the National CHW Program. As Sierra Leone continues to face the world's highest maternal and child mortality rates, reaching every child and woman with essential, life-saving interventions is important, and requires active participation of the community. CHWs bridge the gap between the health facilities by bringing the clinic to communities and communities to the clinic [4]. Further the Trinity college of Dublin study points out that CHWs and mobile technology can go a long way in improving health in the community. From the last step there are still difficult challenges to tackle in achieving sustainable child and maternal health [5]. Using mHealth and CHW to improve health outcomes is an interesting case of how collaboration between organisations can achieve SDG [3].

The National CHW Policy and Strategy, employs a government-led, health- and community-systems strengthening approach that aims to make the CHW Program stronger and better integrated with the overall health system. The changes relate to governance, programmatic details, and support to the CHWs themselves. There is a structure within the MoHS that is fully dedicated to overseeing the program, including direct fundraising, with funds flowing directly through the MoHS. This is aligned with the numerous partnership agreements that Sierra Leone has signed, including the Paris Declaration and the Abuja Accord [1].

Capacity building of CHWs in the rapid infectious disease outbreak era

Understanding how large outbreaks and their management might influence the reporting and delivery of community-based healthcare is critical to the design of resilient health systems in the face of future outbreaks, particularly in settings with pre-existing gaps in facility-based care [6]. It was concluded generally that the CHW Program demonstrated vulnerability, but also resilience, during and in the early period after the Ebola outbreak. Investment in CHWs is required to strengthen the healthcare system, as they can cover pre-existing gaps in facility-based healthcare and those created by outbreaks [7-9]. Having innovative approaches to refresh and retrain CHWs without necessarily having them in workshop contact classes is important to facilitate the momentum.

The Ebola crisis in West Africa has led to the consideration on how CHW work relates to the situation, both in the present and going forward. Implementing partners focused on how CHWs are keenly aware of the Ebola crisis, as front-line workers and can be decisive in the success or failure of crisis responses. The global health partners are aware of the critical role of CHWs in epidemic situations like Ebola, highlighting the need for community knowledge and sensitization, contact tracing and surveillance. This necessitates training CHWs and other health workers on Ebola control activities, sensitization techniques, and safety measures. Accurate information dissemination by CHWs can help control Ebola infection but also help lower the risk of indirect deaths caused by misdiagnosis of conditions like malaria, which is presented in similar ways to Ebola [10,11].

CHWs worldwide played an important role in working towards the health related Millennium Development Goals (MDGs). Their contributions extended from work on reducing child mortality and improving maternal health, to combating HIV/AIDS, malaria and other diseases. CHWs seem to be emerging from the shadows. The current Sustainable Development Goals (SDGs) momentum around CHWs has a number of reasons why this is happening. Among others, SDG targets explicitly ask governments to increase health financing and recruitment, development, training and retention of the health workforce [12]. The deployment of CHWs is increasingly considered as a key strategy to respond to the scarcity of health personnel, particularly in low-income and middle-income countries. There is strong evidence that if appropriately and adequately trained and supported CHWs can be effective in providing preventive,

promotive and limited curative primary healthcare services and improving health outcomes [13].

The mobile training and support (MOTS) service innovation

The Ebola vaccine Deployment, Acceptance and Compliance (EBODAC) project was established to develop strategies and tools to promote the acceptance and uptake of new Ebola vaccines [14]. The overall objective of EBODAC is to develop a communication and engagement strategy including the development of appropriate technology and tools [14,15] like the MOTS in order to maximize Ebola vaccination impact in the targeted population. It implies developing, testing and implementing all necessary activities, pilots and tools to ensure acceptance and compliance with the Ebola vaccination program in Africa, both in support of clinical trials and in the broader vaccination program beyond the clinical trial in case of a licensed vaccine.

The Community Health Worker (CHW) is the backbone of the healthcare system at the household level [16-18] in Sierra Leone and the focus and objective of the MOTS component is to strengthen this network to ensure preparedness for Ebola vaccine campaigns and outbreak response. The project will set up the MOTS service that is the vehicle for delivery of the refresher training, initially focusing on the topics of Vaccines and Outbreak Response. This service will provide mobile training to CHWs *via* their mobile phones with feature phones as the basic requirement [19]. The MOTS service will provide training modules that include units, quizzes, allow monitoring by management and utilisation of the Visual aid during training.

MOTS identifies opportunities to train CHWs more cost-effectively through technology-enabled multimedia content that leverages audio through an Interactive Voice Response (IVR) system. In collaboration with diverse stakeholders such as Ministry of Health and Sanitation (MoHS), District Health Management Team (DHMT) and lower level chiefdom authorities, MOTS innovative design and energetic adoption would make a standout in its new approaches to rural CHWs epidemic response [20].

Main Objective

To assess the functionality of CHWs and readiness to receive the MOTS service package.

Sub-objectives of the study

- To assess the readiness of the CHWs to participate in the MOTS
- To assess the readiness of the CHW system structures to support MOTS
- To perform the functionality of CHWs in relation to the agreed inclusion criteria

Justification of the study

The implementation of the MOTS was agreed upon with the MoHS structures that are responsible for CHWs, Health Promotion and Education, Expanded Program on Immunisation and the e-Health working group. It was agreed that MOTS would be a refresher service that will be used to provide innovative capacity building of CHWs that have already undergone the MoHS recommended training modules. A given set of inclusion criteria was agreed upon that was supposed to be followed in order to enroll the CHWs into the MOTS service. The study therefore set out to provide a platform for CHWs and program components that support the CHWs work to prove their ability to participate in the program.

Methodology

The study design

The evaluation was conducted as a cross-sectional assessment that utilized both quantitative and qualitative data collection methods. The tools had mixed method questions to capture both quantitative and qualitative data.

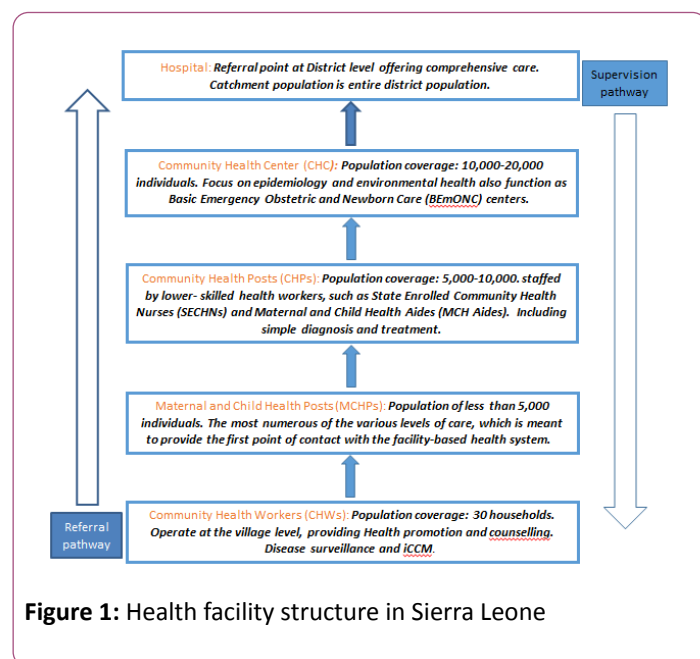


Figure 1: Health facility structure in Sierra Leone

Study area

The study was conducted in Bo district in the Southern Province of Sierra Leone found in West Africa. It is the second most populous district in Sierra Leone after the Western Area Urban District. Its capital and largest city is the city of Bo, which is the second largest city in Sierra Leone. The study covered 5 major chiefdoms of Bagbo (5,403 population), Jaiama Bongor (31,298 population), Bumpo-Gao (44,279 population), Lugbu (25,453 population) and Tikonko (53,206 population) with a 51.2% female and 48.8% male population disaggregation [21].

The study followed follows the MoHS implementation structure (Figure 1).

The target population groups

The target population was the users of the MOTS service based on the MoHS recommended implementation and supervision structure for the CHWs in the implementation sites (Table 1).

Sample size determination and justification

The study followed a number of sampling techniques depending on the requirement of the given sample. The chiefdoms were purposively selected because they fall under the operational area of World Vision Sierra Leone in Bo district. This further influenced the PHUs to be included in the study. Since the 5 chiefdoms have 45 PHUs, the study includes all the PHU in-charges as a census.

Focusing on the 300 CHWs, the project utilized the random sampling method using the table of random numbers. All the chiefdoms provided an equal sample to the study. Each CHW chosen meant that households from his catchment would be selected. The utilization of only 300 CHWs was linked to availability of resources for the project. The 300 household samples were aligned to the number of CHWs sampled. The assumption was that each CHW interviewed provided a sample of one locality from which a household would be interviewed and therefore an equal sample. The MoHS and DHMT included in the study are those that directly supervise CHW work in Bo region.

Data collection tools

The CHW Functionality Assessment Questionnaire Tool was used to assess CHW readiness to use MOTS. The information collected using this tool is what was used to determine which CHWs met the inclusion criteria for MOTS. To assess the status and readiness of the immediate CHW supervisors at the PHUs, the CHW in-charges Functionality Assessment Questionnaire Tool was developed. This was used to gather perspectives from the PHU in-charges. To assess the status of the readiness for the MoHS structures to support the implementation of MOTS, the DHMT/CHW-Hub Functionality Assessment Questionnaire Tool was used. This tool focused on the MoHS CHW Hub team members and the DHMT staff who are directly responsible for the CHW interventions. To assess the contribution of the CHWs to the households in the catchment area, the Households Service Delivery Tool was used. This was to assess the perceptions of the community as far as the content of the two modules are concerned.

Enrolment criteria into the MOTS service

For each category of study participants, there was a given inclusion criterion to be met to be able to go beyond just being a sampled participant. Since the assessment was meant to

determine the functionality and therefore inclusion into the actual MOTS roll out process. **Table 2** presents the agreed inclusion criteria per sample.

Table 1: Targeted populations

No.	Target population	Required numbers	Justification of population inclusion
1	CHWs	300	The CHWs are expected to be the users of the system and receive mobile training through self-service. They are the primary participants in the study. The Pilot requires 125 CHWs in total so for the functionality assessment a larger number was required to be able to select the 125 active CHWs.
2	PHU in-charges	45	The in-charges will have access to reports on how their CHWs are performing and do follow up on those that have not yet completed a given module. A census of all PHUs needed to be included since CHW selection was expected to come from any PHU in the study area.
3	DHMT	4	Level 1 Administrators will mainly interact with the system via a web interface or a smartphone app for MOTS and have access to reports. In the systems strengthening approach the members of the DHMT supervise the in-charges and oversee all capacity building in the district. The District has 4 authorities that deal directly with the CHWs.
4	MoHS	4	Level 2 Administrators will be responsible for defining module structure and uploading course content into the MOTS system. In the systems strengthening approach, it's the MoHS that is responsible for planning and implementing capacity building. Even in MoHS, the MoHS takes this role. The Bo district is in the southern region with 4 focal points at MoHS responsible for this role from 4 key sectors of: Community health, Immunisation, E-Health and Health promotion.
5	Household members	300	The overall anticipation is that the CHWs shall use the knowledge acquired through MOTS to boost up their counselling activities at the community level and therefore the inclusion of this sample. Each CHW selected shall mean inclusion at least one household from his catchment area.

Table 2: Program inclusion criteria

No.	Target population	Inclusion criteria
1	CHW	Willing to fully participate in the pilot. Must be reporting to the PHU. Must have a functional mobile phone. Should be based in the geographical location of the PHU assigned.
2	PHU in-charges	Must have a smartphone. Should be supervising the CHWs.
3	DHMT	Must have a functional laptop, internet connectivity.
4	MoHS	Must have a functional laptop, have supervisory roles to the geographical location.
5	Community members	Must be residents in the geographical location of the eligible PHU. Should have been visited by the CHW who has been included in the study. Willing to participate in the study.

Data analysis

Data was entered into Excel on a daily basis by the data entrants, and a two-stage cleaning process was established. Firstly, the Lead Data Manager combined and reviewed all entered data and provided feedback to the data entrant team on any misunderstood pieces of data. If the coded fields were not clearly marked, the field team, during the review process was consulted on the interpretation. The second stage of data cleaning was done by the two project statisticians. All quantitative data was analyzed using Excel, into absolute numbers then percentages basing on the totals. While qualitative data was analyzed through a review process that facilitated the generation of commonalities in the responses, then clustered into major themes and ideas and these were ranked and turned into quantitative data.

Data privacy

The collection and processing of CHW data was limited to the data necessary to fulfil the MOTS objectives and as approved by

the MoHS of Sierra Leone. This is because the information that was collected from the CHWs included very sensitive and privileged data. This data was collected and processed with adequate precautions to ensure confidentiality and compliance with applicable data privacy protection laws and regulations as set in the MOTS protocol of implementation. Appropriate technical and organizational measures to protect the personal data against unauthorized disclosures or access, accidental or unlawful destruction, or accidental loss or alteration was observed. Key personnel whose responsibilities require access to personal data agreed to keep the identity of CHWs confidential.

Ethical consideration

The study sought and obtained ethical approval from the Office of the Sierra Leone Ethics and Scientific Review Committee of Ministry of Health and Sanitation Directorate of Policy, Planning and Information (DPPI) Youyi Building, Fifth Floor, East Wing before it was conducted. In addition, the study was approved under version number 12/03/2017. Informed

consent was sought from the households interviewed by signing on the administered consent form (ICF).

Study limitations

The data collection exercise was conducted during the period just preceding national elections, with some CHWs and respondents being actively involved in the political activities and not available at the time the research teams needed their support.

Some of the randomly selected CHWs and villages were unreachable by normal means of transportation. Most of the times, it was not possible to meet the targeted number of respondents for the day. The team had to extend working hours in order to achieve the targeted population for the study.

The data collection process coincided with the PHU in-charges monthly meeting at the district headquarters. This affected the planned PHU in-charges census as some of them were not reachable at their PHUs.

Results

For all the specific results summarized in this section, please see the corresponding tables and figures section designated in this paper.

Social demographic characteristics of participants

The study attracted 264 CHWs representing 88% of the target for inclusion into the study. The 12% CHWs that were not included into the study even when sampled were not reached due to the geographical challenges of the terrain, and non-availability due to participation in post political events during the survey period. 74% of the CHWs interviewed were male while only 26% were female. 303 household members were interviewed, representing 101% of the sampled population. The household population interviewed was a deviation from that of the CHWs by sex representing 70% female and 30% male. The interviews happened during the day and therefore it was the females that were found at the household during that time. The study also managed to interview 32 PHU in-charges out of the 45 planned censuses representing a 71% fulfilment. The 29% of PHU in-charges not interviewed were not available due to the post-election activities in the Bo district at the time of the survey.

The study also focused on the allocation of CHWs and PHU in-charges by level of PHU. For the CHWs interviewed, 41% were drawn from Community Health Centers (CHCs), 34% from Community Health Posts (CHPs) and 25% from Maternity Community Health Posts (MCHPs). This was because in accordance to the MoHS Guidelines, a CHC covers a large geographical area and therefore during sampling provided a large sample size for CHWs to draw from. The geographical frame then decelerated to the CHP and finally to the MCHP [22]. However, when it came to the inclusion of PHU in-charges into the study, the MCHP provided 50% of all the in-charges into the study, CHC provided 34% of the study subjects and CHP provided only 16%. The order was supposed to be MCHP, CHP and then

lastly CHC and this would have been because of the MoHS structure provides for more MCHP, followed by CHP and then CHC since this provision follows the referral pathway [23] as shown in **Figure 1**, and the care provided. This was not the case since most CHPs visited did not have the PHU in-charges present due to the post-election activities during the study period.

Focusing was on the distribution of study participants by chiefdom. When it comes to the CHWs who participated, 25% were selected from Bumpe as the highest provider and Jiama Bongor provided the least standing at 13%. At the sampling time, each chiefdom provided an equal number, however as highlighted earlier, some participants were not readily available at the study time. The highest provider of participants for the household survey was Jiama Bongor with a 29%, followed by Bumpe with a 21%. The chiefdom that provided the least participants was Bagbo with a 13% of the 303 participants interviewed. The project set out to perform a census for the 45 PHUs however not all participated. From the 5 chiefdoms, Bumpe PHU in-charges were readily available with a 34% provision. The least chiefdom availing PHU in-charges was Bagbo with a 6% provision.

One other demographic feature that was assessed for CHWs alone was age. The age category 46-55 years provided the highest percentage of CHWs, 34%. There were only 3% of the CHWs in the age category below 25 years with 8% of the CHWs coming from the age category of above 66 years. The study revealed a very interesting dynamics that is; 61% of the CHWs being above 46 years. This is the age category that is considered not youthful. This has an advantage of having mature CHWs that have experience and may be used for influencing and supervising the youthful age [24]. However, for the utilization of mobile technology, it is mostly believed that the age of preference for the CHW to navigate the system would be below 45 years [25]. The younger the CHWs, the more technology compliant they would be because they are considered more technologically active than the older CHWs (**Table 3a-3d**) [26].

Table 3a: Social demographic characteristics of participants by sex.

No	Sex	CHWs		House Hold	
		No	%	No	%
1	Male	141	74.00	89	29.00
2	Female	70	26.00	214	7.0
Grand Total		264		303	

Table 3b: Social demographic characteristics of participants by location.

No	Chiefdom	CHWs		House Hold		PHU-i	
		No	%	No	%	No	%
1	Bagbo	61	23.00%	40	13.00%	2,00	6.00%
2	Bumpe	65	25.00%	63	21.00%	11	34.00%

3	Jiama Bongor	35	13.00%	87	29.00%	4.00	13.00%
4	Lugbu	42	16.00%	54	18.00%	7	22.00%
5	Tikonko	61	23.00%	59	19.00%	8	25.00%
Grand Total		264		303		32	
PHU-i: PHU-incharge							

Table 3c: Social demographic characteristics of participants by Level of PHU attached to.

No	PHU Level	PHU-i		CHWs			
		No	%	No	%		
1	CHC	11	31.00%	107	41.00%		
2	CHP	5	16.00%	91	34.00%		
3	MCHP	16	50.00%	66	25.00%		
Grand Total		32		264			
PHU-i: PHU-incharge							

Table 3d: Social demographic characteristics of participants by Age categorisation of CHWs.

No	Age	No	%
1	<25yrs	7	3.00%
2	26-35yrs	46	18.00%
3	36-45yrs	47	19.00%
4	46-55yr	87	34.00%
5	56-66yrs	47	19.00%
6	>66yrs	19	8.00%

CHW readiness to participate in the MOTS

One of the key readiness considerations was CHWs willingness to actually be trained [27] through a mobile platform. The CHWs’ willingness to be trained using a mobile phone was assessed by their level of acceptance to receive IVRs through the phone as refresher. Almost all CHWs (99%) showed acceptance for having refresher training through the phone. This acceptance rate is indicative that whichever CHW that will be selected for inclusion into the training program will be motivated to actually login and do the training.

The MOTS project was focused on strengthening the healthcare system [28]. One of the ways the MOTS program was going to achieve this was working with CHWs who actually do home visits and provide periodic reports to the PHUs. During the interviewing process, the CHWs were asked to bring their Household and Surveillance registers. This was because the two IVR modules that were going to be sent are emphasizing the need for reporting. Of all CHWs interviewed, 97.7% presented a household register (H. Register) and 96.6% presented a Surveillance register (S. Register). The MoHS recommends that

all CHWs need to be in possession of these two registers for purposes of timely reporting [29].

One of the key functions that will be played by the CHWs is to be able to read the welcome SMS [30]. This therefore necessitated the CHWs to be tested for the ability to read. A given text “I promote the health of mothers and children in my community” was supposed to be read out loud by the CHW in his or her preferred language. From the results, 87.1% of the CHWs interviewed could actually read (Reading) an additional assurance that actually logging into the system by the CHWs will not be a problem.

The other important issue that was looked into with the CHWs was the functionality of their mobile phones. The study focused on the functioning phone keys and had a clear phone screen. This is because as the CHWs listen to the IVR, they will be asked to press some phone keys as a form of response to the quiz, and for them to be able to kick start the training, the CHWs should read the initial message on a clear phone screen. 80.7% (Phone screen) of all CHWs had a phone with a functioning screen at the time of the survey. This therefore meant that up to 20% of all CHWs with mobile phones cannot read any message sent to them since the screen was not visible. Further still 82.6% (Phone keys) of all CHWs with mobile phones had phone keys functional, with all numbers visible and dialling in (Figure 2).

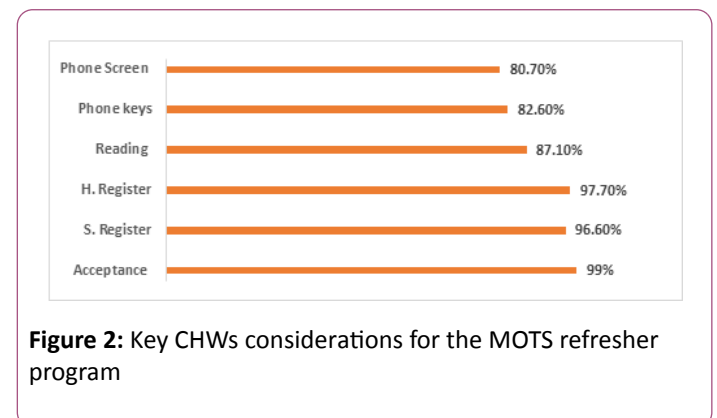


Figure 2: Key CHWs considerations for the MOTS refresher program

CHW language determination

The MOTS program will be facilitated through IVRs. For this to be effected there is a need for the developed content to be tailored into the language that is easily understood and interpreted by the CHWs. Each CHW interviewed was put to a test about this aspect of the program, through confirming that there is a particular language they are comfortable interacting in during the interview and further can actually read in that language or prefers another for reading purposes. Results show that there were basically 3 common languages used as a medium in the 5 chiefdoms, these include Mende, Krio and English. The most spoken language was Krio with a 52.65% prevalence followed by Mende with a 45.08% score with English having the least spoken rate of 2.27%. However, it was revealed that even though majority of the CHWs are not comfortable speaking English, it’s the only language they can read with ease. In this regard 82.95% of all CHWs interviewed could only read and interpret an English text without struggling. It is important to note that there was a 12.12% of CHWs who could not attempt

to read text in any form of languages presented to them. This is contrary to the MoHS guidelines recommendation of practice that emphasizes a CHW should be able to read and write [1] since they have a responsibility of reading and writing in their deliverables (Figure 3).

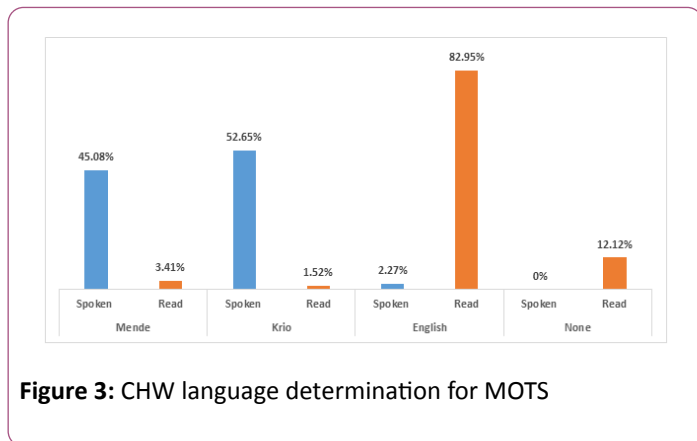


Figure 3: CHW language determination for MOTS

CHWs capacity determinants

The MoHS provided guidance to the MOTS project that included working with CHWs that have been trained in the approved national curriculum for CHWs [31]. The MoHS further recommended that the CHWs to be included in the MOTS pilot should be recently trained since the New Curriculum was rolled out in the past year. This was also deliberate to focus on the CHWs who are actually active and have been carrying out their quality household visits as stipulated in the CHW policy guidelines. Results of the survey show the extent to which the CHWs contribute to the desired guidance. When focusing on the CHWs who have been trained in the generic package, 87.5% of CHWs claimed to have been trained in the 7-12 months preceding the survey, with only 1.9% claiming to have been trained more than 12 months preceding the survey period. This revelation confirms the MoHS recommendation that majority of the CHWs must have been trained within this same year of data collection.

During the capacity building process, the CHWs are facilitated to map out their actual coverage area by households. The mapping exercise is in line with the national recommendation of each CHW allocated not more than 30 households. During the capacity building week, all CHWs include the numbers of their households into their register for follow up. Results show that 42.8% of the CHWs interviewed oversee the recommended 30 or fewer households in a given community. The second largest category shows that 39% of the CHWs oversee more than 50 households. MOTS anticipate that the CHWs need to have ease of coverage to be able to actually pass on the messages learned from the IVRs during the refresher MOTS service.

The other aspect was to determine whether the CHWs were actively visiting the households they oversee. Only 44.3% of the CHWs had visited their households 2 weeks before the survey while 18.9% of the CHWs assessed had taken more than 4 weeks without visiting the households. It's a recommended practice for CHWs to perform adequate quality house hold visits since they

are the first line of affordable healthcare (Figure 4 and Table 4) [31,32].

Last household Visit			
No	Before Survey	No	%
	0-2 weeks	117	44.30%
2	3-4 weeks	97	36.70%
3	>4 weeks	50	18.90%
4	Can't recall	2	0.80%
Face-to-face training			
No	Before Survey	No	%
1	0-6 months	45	17.00%
2	7-12 months	213	87.50%
3	>12 months	5	1.90%
4	Never	1	0.40%
Households overseen			
No	Number	No	%
1	<=29	113	42.80%
2	30-40	32	12.10%
3	41-50	25	9.50%
4	>50	103	39.00%

CHWs MOTS implementation considerations

CHWs participation in the MOTS requires a few considerations that contribute to the enabling environment that facilitate modular IVR training. These include the following: the training content for services they offer, their level of education, the mobile network status at the CHWs home and any anticipated challenges.

From the interviews conducted, CHWs were concerned about these challenges during MOTS: a 91.7% having difficulty in charging their phones, 45.1% fearing very poor network, and a 12.9% claiming that they may have difficulties operating the phone. 9.8% of the CHWs felt that the status of their batteries would be a problem since they deemed it to be bad. It is important to note that a 7.2% of the CHWs did not have any anticipated challenge. This therefore means that only 7.2% of the CHWs were totally free from fear to participate in the MOTS service as far as mobile phones were concerned.

For the CHWs to receive the initial message, the geographical location should have sufficient mobile network. An observation was done targeting the number of bars on the phone of the CHW at the time of interview. 32.2% of the CHWs had the required three bars for a call to be placed and an IVR to be listened to. Another 24.6% of the CHWs presented with two bars in the location of the interview place. This observation was included on assumption that the CHW was interviewed at his most convenient place able to call in for the modular IVRs.

The study required the level of academic potential to determine the level of capacity building and supervision that will be offered to the CHWs. If the study reveals that majority of CHWs have a none or low level of education, the project would be able to tailor the training and mentorship support to the level of education that the CHWs portray. From the results, only 11.7% of the CHWs had no educational level. These 11.7% meeting the selection criteria will need the highest level of support able to complete the training. The study also revealed that 40.2% of the CHWs have gone up to senior Secondary level and therefore should easily comprehend the navigation around the mobile phone. This was followed by a 29.2% that completed junior Secondary.

The MOTS service initially focuses on vaccination and surveillance for outbreaks within the community. The principle of having a service that can be used to refresh CHWs, was aimed at making sure that whatever is discussed through the service can be translated into a counselling objective for the CHWs. MOTS therefore included a question focusing on what is discussed at household level, looking for anything around vaccination and other common services as guided by the CHW policy framework for Sierra Leone [32]. Discussions and support around child vaccination scored a 95.9%, malaria prevention scored 96.5%, and breastfeeding support scored a 93.9%. The least discussed theme that was included in the study was the encouragement of male involvement with a 75.4% score (Table 5).

Table 5: CHWs MOTS implementation considerations.

CHW Anticipated challenges during the Training			
No	Challenge	Freq.	%
1	Difficulty in charging the phone	242	91.7%
2	Poor network	119	45.1%
3	Difficulties to operate the phone	34	12.9%
4	Bad phone battery	26	9.8%
5	None	19	7.2%
Services offered by the CHWs			
No	Services offered	Freq.	%
1	Malaria Prevention	255	96.6%
2	Child Vaccination	252	95.5%
3	Hand washing	251	95.1%
4	Breastfeeding	248	93.9%
5	Male involvement	199	75.4%
CHW Educational level			
No	Level	Freq.	%
1	Pre-primary	1	0.4%
2	Primary	26	9.8%
3	Junior Secondary	77	29.2%
4	Senior Secondary	106	40.2%

5	Tertiary	22	8.3%
6	University	1	0.4%
7	None	31	11.7%
CHW's phone Network Status			
No	Network bars	Freq.	%
1	One (25%)	18	6.8%
2	Two (50%)	65	24.6%
3	Three (75%)	85	32.2%
4	Four (100%)	43	16.3%
5	No bar at all	11	4.2%
6	Not applicable	42	15.8%

PHU in-charges' considerations for MOTS refresher program

The MOTS implementation framework recommends that the PHU in-charges shall be the frontline and immediate supervisors to the CHWs [33]. They are responsible for making sure that CHWs login and complete the modular IVRs in the stipulated time of 4 weeks. For the PHU in-charges to perform this role there are a number of considerations including possession of a functional smartphone to monitor the CHWs online, looking at login, starting and completion of modules. From the assessment only 56.25% of the PHU in-charges had a smartphone. This therefore means that 43.75% of the PHUs assessed cannot provide online supervision for the CHWs during the training period.

The perspective of the PHU in-charges towards using a mobile phone service to refresh CHWs was also assessed. The PHU in-charges were asked whether they would recommend their CHWs to actually have training using a mobile phone. Almost all (96.9%) PHU in-charges interviewed strongly recommended the utilization of a mobile phone to refresh CHWs. This presented a great mindset for the program since the CHWs supervisors presented a positive attitude towards the MOTS service.

The PHU in-charges' ability to supervise CHWs was ascertained by asking them to provide a list of CHWs attached to the PHU. This aspect also focused on whether the list exits at the PHU, better still if they had a schedule for CHW involvement. In this regard 90.6% of PHU in-charges had the lists pinned in the health facility. It is important to note that 9.4% of the PHU in-charges did not have the list of the CHWs with them, and this could be a hindrance to the supervision mechanism for a CHW (Figure 4).

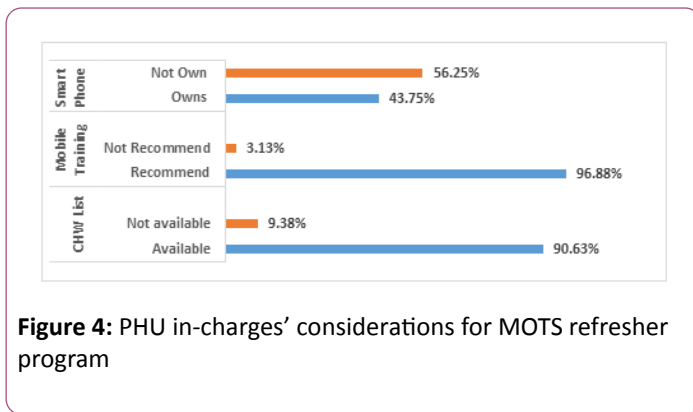


Figure 4: PHU in-charges' considerations for MOTS refresher program

PHU in-charges' supervision capacity and anticipated challenges

PHU in-charges needed to articulate the anticipated challenges CHWs would face during the MOTS service. In this regard 50% of the PHU in-charges pointed out access to charging facilities for CHW phones due to a challenge of power and trek taken to have phones charged. Another 59% of the PHU in-charges pointed to inadequate mobile network and struggles to get a good signal to access the MOTS system.

The PHU in-charges also needed to provide the number of CHWs in the catchment [34]. The PHU in-charges who supervised up to 10 CHWs contributed 50% of the sampled PHUs. This is in line with the MoHS structures since most PHUs included in the study are MCHP and have a relatively small geographical coverage. 38% of the PHU in-charges provide supervision to 11-20 CHWs and 13% provide supervision to 21-30 CHWs (Table 6).

Table 6: PHU in-charges' supervision capacity and anticipated challenges.

CHW Visitation of Households in the 2 months before survey			
No.		Freq	%
1	Visitation done	252	83.17
2	Visitation not done	51	16.83
Household Lessons			
No	Services offered	Freq.	%
1	Malaria Prevention	244	80
2	Hand washing	230	75.4
3	Breastfeeding	226	74.1
4	Child Vaccination	216	70.8
5	Male involvement	190	62.3
Usefulness of Lessons by CHWs			
No		Freq.	%
1	Not useful	1	0.4
2	Somehow useful	0	0
3	Useful	17	6.6

4	Very useful	239	93
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Household appreciation of CHWs role

The MoHS recommended for MOTS service to consider the role played by the households. All CHWs who participate are expected to eventually perform household visits and the actions are supposed to guide household counselling [35,36]. The households interacted with during the survey needed to first ascertain whether in the 2 months preceding the study, they were actually visited by a CHW. Results shows that 83.1% households surveyed had been visited by the CHW in the period of 2 months before survey. This very high percentage speaks to the fact that the MoHS in Sierra Leone is facilitating a functional and operating CHW. This will be an added advantage for the MOTS service since there is assurance that the CHWs actually do perform their household visits.

The household were asked to mention the services they received from the CHWs. These services were bundled in accordance to the guidance provided by the MoHS policy document for CHWs [1]. The outcome of this particular issue is in line with what the CHWs claimed to have been doing during the visit, however the percentages are much less than the ones claimed by the CHWs. The highest point of support being offered by the CHWs is counselling and support for malaria prevention with 80%. Adequate water, hygiene and sanitation practices scored second with a 75.4%, 29.2% of the households did not mention child vaccination as one of the issues CHWs support them on. This gives the MOTS a basis to contribute and add value to the support required from CHWs.

All households who reported having been counselled by a CHW, were asked to rate the usefulness of the information received. The assessment rating process was guided by the 3 bean selection. Household member interviewed were asked to pick the beans in relation to how the information supported them perform a given practice or action. The rating was between 0-3 with 0 being not useful and 3 being very useful. Results from the survey showed that only 0.4% of the participants did not see the usefulness of the information provided, with 6.6% seeing the information as useful and a 93.0% of the participants rating the information as very useful. This gives an edge to the MOTS service that the community actually have great trust and respect [37] for the work being done by the CHWs and therefore the refresher information shall be taken with utmost respect and trust by the community (Table 7).

Table 7: Household appreciation of CHWs role.

Anticipated challenges			
No.	Challenge	Freq.	%
1	Poor network	19	59
2	Inaccessible charging facilities	16	50
3	Lack of network	5	16
4	Illiteracy	4	13

5	Lack of top-up	1	3
6	Effectiveness of the training	1	3
CHWs supervised			
No.	Ranges	Freq.	%
1	0-10	16	50
2	11 to 20	12	38
3	21 to 30	4	13

CHWS who met the inclusion criteria for MOTS service

In order to select the required CHWs for the inclusion in the MOTS service, a systematic filter process was employed following the criteria as stated in the protocol [20]. Filtering process included CHWs in the geographic location, willingness to participate, reports to the PHU and has a functional mobile phone. After these filters, the names were forwarded to the MoHS team to select the 125 based on the degree of activity.

All CHWs (100%) proved their residence of the project area. The second filter performed was to ascertain the CHW's willingness to participate and 99.2% of the CHWs were willing to participate. The same percentage (99.2%) was able to mention a PHU within the coverage area. 82.2% of the CHW's phone keys were functional on their mobile phone and 79.2% of the CHWs phone had a clear screen.

The functionality of CHWs to participate in the MOTS service was 79.2% (209). These therefore met the inclusion criteria for MOTS service. However, the project set out to work with only 125 CHWs, and this necessitated the utilization of another selection process. This being a pilot, the project needed active and functional CHWs. A team from the DHMT and the MoHS CHW-Hub was asked to review the list of 209 and select 125 CHWs (Figure 5).

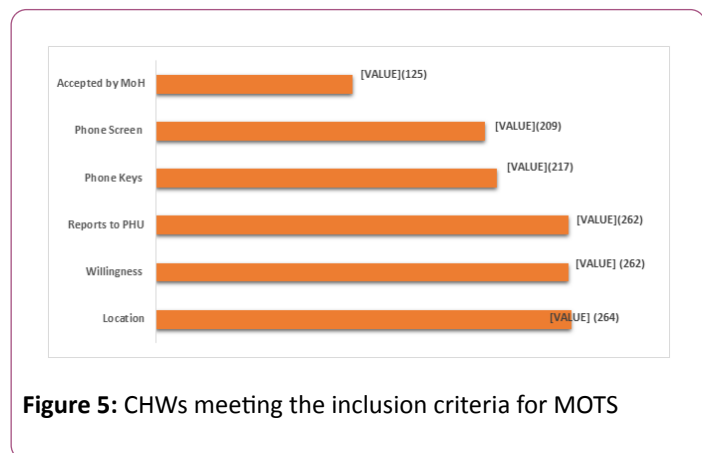


Figure 5: CHWs meeting the inclusion criteria for MOTS

PHU in-charges meeting the inclusion criteria for MOTS

The inclusion of PHU in-charges into the MOTS service aimed at adequate follow up and support during the training [38]. The PHU in-charges must have a smartphone and offer supervision

to CHWs. All PHU in-charges (100%) interviewed supervise CHWs.

The study proposed another variable to prove that CHW support actually happens, the PHU in-charges needed present a list of CHWs and their contacts, including a work schedule [39]. In this regard 90.6% of PHU in-charges met these criteria.

Possession of a smartphone indicated only 40.6% of PHU in-charges met this criterion. Having a smartphone meant that the platform for follow up of CHWs would easily be installed on the phone for monitoring progress (Figure 6).

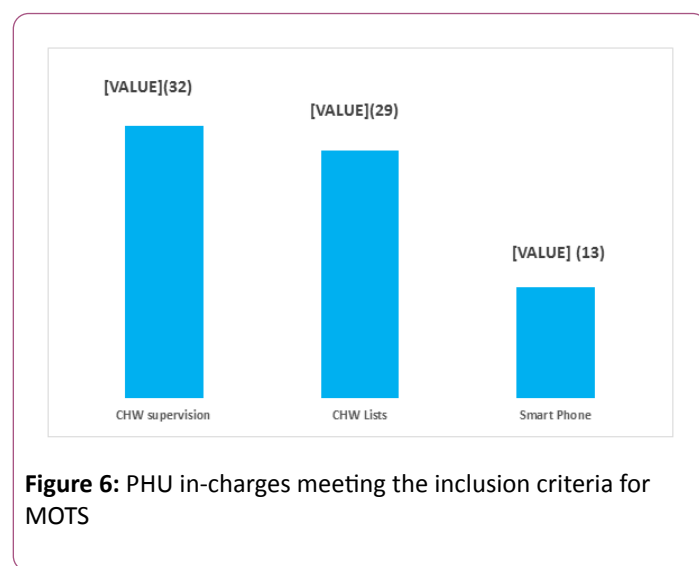


Figure 6: PHU in-charges meeting the inclusion criteria for MOTS

Discussion

Among the many forces driving the eminent need for innovation in healthcare is timely access to health services in the most remote locations and the urge to reach the most vulnerable populations. The traditional care delivery models are being overwhelmed as a result of the rapidly increasing prevalence of chronic disease [40]. There are looming shortages of frontline mainstream healthcare providers, raising costs of care and a suffering productivity of the health workforce due to multiple priorities at the point of service provision. Information and communication technologies offer a window for tremendous innovation in healthcare. These offer considerable promise for enabling entirely new models of healthcare both within and outside of formal systems of care, and offer the opportunity to have a larger and more efficient public health impact. A number of tools exist to monitor and capture real-time data about individuals' health status through user input into mobile applications [41]. Further, decision support tools are increasingly being developed to facilitate the health system to better understand, access, and make choices about the population served.

Opportunities for mobile technologies to play a pivotal role in health services, particularly in low-income countries, are increasingly being recognized as mHealth can now support performance of health workers through the dissemination of clinical sensitive updates (Continuous Medical Education), offering learning materials, and reminders, particularly in

underserved rural locations where CHWs are considered a very important frontline cadre to offer health services [42-44]. Until recently there has generally been lack of mHealth applications and services operating at scale. There has been one most common use of a one-way text message and phone reminders to encourage follow-up appointments, healthy behaviors, and data gathering [45]. Innovative mHealth applications for CHWs include the use of mobile phones as job aides, clinical decision support tools, and for data submission and instant feedback on performance [44] with the MOTS service facilitating the IVR channel for capacity building and knowledge assessment. By harnessing such an innovation among diverse populations, there is a promising suggestion that mHealth can be used to deliver increased and enhanced healthcare services to individuals and communities, while helping to strengthen health system at the lowest level of care [42].

With the current consistent shortage and inadequate distribution of the health workers in Sierra Leone, the MoHS is increasingly relying on the CHWs for the delivery of primary care [46]. The MoHS intervention to operationalize the CHWs has gone a long way in ensuring that each PHU has fully trained and equipped CHWs. Evidence from this study shows that 79.2% of all CHWs assessed were functional for MOTS-an indication that MoHS has done a tremendous job in rolling out the CHW policy framework for Sierra Leone [1,23]. MoHS' support to the CHWs is evidence of contributing to the effectiveness in delivering health services to communities and the improvement of health outcomes across specific thematic area in healthcare as stated in the healthcare package for the country [1]. Even with a very commendable functionality rate of 79.2%, CHWs remain vulnerable to an inadequate and very low motivation structure, poor or non-existent financial remuneration, inaccessible terrain and isolation [47]. The implementation of MOTS will be coupled with non-existent mobile network, existent but unreliable mobile network, difficulty in finding all round charging system and phones having poor batteries.

The vision of the MoHS in Sierra Leone is to have an adequate, well-managed and efficient system in place that will create a motivated human resource of health fully empowered staff to provide equitable access and distribution of services leading to a healthy and productive Sierra Leone [48,49]. The MOTS assessment focused on key indicators that contribute to this, and there was a 90.6% of PHU in-charges who actually performed the function of supervision for CHWs. It therefore implies that the 9.4 PHU in-charges were providing ad hoc, inadequate, and non-existent support supervision to the CHWs attached to their PHUs [50-52]. Since MOTS requires the availability of a smartphone for the PHU in-charge to functionally support MOTS, only 40.6% of the PHU in-charges managed to meet this functionality requirement. If the Sierra Leone Health sector is going to adapt the MOTS service, there is need for availability of smartphones in addition to making charging facilities available, and dealing with lack of network.

CHWs are considered the backbone of an efficient healthcare system in low-income countries like Sierra Leone [53]. For the CHWs to perform effectively there is need for refresher of trainings. The refresher training needs to be carefully planned

and can be done face-to-face [54] or even through voice messages which is what MOTS would suggest, sending IVRs through the mobile phone. This in the long run provides an effective way of reminding CHWs and providing guidance on key actions expected [55] at the counselling level. With a 99% acceptance rate, CHWs are willing to be refreshed through mobile phones. This willingness points to the fact that technology if rolled out in a collaborative and systematic approach can contribute to capacity building of CHWs.

Recommendations

Mobile network infrastructure is key in MOTS service roll out

The baseline exercise revealed that it is paramount to have the mobile network infrastructure assessed and understood for a successful implementation. Implementing through a strong and reliable network provides a structured foundation for a good mobile process [56]. At the local level there is a distinct difference between availability of network and reliability of that network. For a large scale roll out, these two factors have to be studied well before implementation kicks off.

Implementation through the government health system approach is key

For MOTS to yield the desired results there is need for the pilot and implementation mechanism to deliberately work with the Sierra Leone healthcare system. This is because health systems strengthening indicate the actions taken to achieve the goal of universal health coverage that includes access to quality essential healthcare services at the community level [56]. This baseline study was rolled out in a collaborative function with the MoHS different technical working groups and the DHMT. This working relationship provided a smooth preparatory platform and approval for the study.

Work through a functional CHW to deliver on MOTS

If MOTS is to strengthen the system and further present evidence that the MoHS can actually adopt the platform as a refresher tool, there is need for the operations of MOTS to happen with a functional CHW. This is because a functional CHW easily bring care closer to where mothers and children are and therefore contributes to the increase in equity and access immediately after the training [56]. If this implementation strategy presents an opportunity for cutting costs and delivering evidence with the current minimal resources, then the MoHS can adapt the platform for further programming.

Conclusion

Utilization of the modular IVRs through the MOTS platform to facilitate the refresher training to CHWs is very possible. This is because from the assessment, 79.17% (209) CHWs met the inclusion criteria for MOTS. At the CHW level, the willingness to participate was rated at 99%. This coupled with the MoHS support will contribute to the success of the program.

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