Remote Primary Healthcare Consulting in Low- and Middle-Income Countries: Feasibility Study of an Online Training Program (REaCH) to Support Care Delivery During the COVID-19 Pandemic

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Abstract

Introduction

Despite acceleration of remote consulting throughout the COVID-19 pandemic, many healthcare professionals are practising without training to offer tele-consultation to their patients. This is especially challenging in resource-poor countries, where telephone has not previously been widely used for healthcare.

Objective

As the COVID-19 pandemic dawned, we designed a modular online training program for REmote Consulting in primary Healthcare (REaCH). To optimise upscaling of knowledge and skills, we employed a train-the-trainer approach, training health workers (tier 1) to cascade the training to others (tier 2) in their locality. We aimed to determine if REaCH training was acceptable and feasible to health workers in rural Tanzania to support their healthcare delivery during the pandemic.

Methods

We developed and pre-tested the REaCH training program in July 2020 and created eight key modules. The program was then taught remotely via Moodle and WhatsApp to twelve tier 1 trainees and cascaded to 63 tier 2 trainees working in Tanzania's rural Ulanga district (August-September 2020).

We evaluated the program using: a survey (informed by Kirkpatrick's model of evaluation) to capture trainee satisfaction with REaCH, knowledge gained; and perceived behaviour change; qualitative interviews to explore training experiences and views of remote consulting; and documentary analysis of emails, WhatsApp texts and training reports generated through the program. Quantitative data were analysed using descriptive statistics. Qualitative data were analysed thematically. Findings were triangulated and integrated during interpretation.

Results

Of the twelve tier 1 trainees enrolled in the program, all completed the training, however two encountered internet difficulties and failed to complete the evaluation. Another opted out of the

cascading process. Sixty-one tier 2 trainees completed the cascaded training. Of the ten tier 1 trainees who completed the survey, all would recommend the program to others, reported receiving relevant skills and applying their learning to their daily work, demonstrating satisfaction, learning and perceived behaviour change.

In qualitative interviews, tier 1 and 2 trainees identified several barriers to implementation of remote consulting, including lacking digital infrastructure, few resources, inflexible billing and record-keeping systems, and limited community awareness. The costs of data or airtime emerged as the greatest immediate barrier to supporting both the upscaling of REaCH training and subsequently to the delivery of safe and trustworthy remote healthcare.

Conclusion

The REaCH training program is feasible, acceptable and effective in changing trainees' behaviour. However, government and organisational support are required to facilitate the expansion of the program and remote consulting in Tanzania and other low resource settings.

Introduction

Essential health services are not available for over a third of the world's population and most of this population is in low- and middle-income countries [1]. Marginalised communities, including those living in rural areas and informal settlements or slums have least access to high-quality healthcare [2]. High-quality care includes appropriate and timely treatment and follow up [2] and its provision forms part of the United Nations Sustainable Development goal for health [3].

Even prior to the COVID-19 pandemic, remote consulting was considered to have the potential to increase access to quality healthcare, especially in rural communities [4-6]. It is estimated that 85% of individuals across low- and middle-income countries (LMICs) own a mobile phone [7]. While Tanzania has lower rates of ownership, it still has 75% mobile phone ownership across the population and 90% among health workers [8]. Mobile phone ownership is lower amongst rural, older, illiterate and female populations compared to other population groups, but is rapidly increasing [4, 7]. Patients find remote consulting acceptable and appreciate the consistency and continuity of care achieved through improved communication [9].

From the beginning of the COVID-19 pandemic, the World Health Organization recommended remote consultation using phones or video-conferencing as an option for protecting the safety of patients and health-workers and to enable continued healthcare provision [10, 11]. Globally, in the face of the pandemic, remote consulting increased, but often with little preparation and training [12]. This lack of training in the use of health technology is a key barrier to acceptance and uptake of remote consulting in LMICs [4, 13] along with health workers' worries about increasing personal workload [9].

Globally, continuing medical education delivered remotely has been shown to be acceptable, feasible, and desirable [14]. It enables greater geographic accessibility and time flexibility [15] and has been shown to be as effective as traditional teaching methods and far more effective than no training [16, 17]. Issues of network connectivity, costs of data/airtime, access to electricity, and usability of the device are challenges that need to be addressed [18].

This paper first describes a remotely delivered education program called REaCH (REmote Consulting in primary Healthcare) aimed at equipping healthcare workers in LMICs with knowledge, skills and confidence to conduct remote consulting. We then present a two-phase approach to evaluation: a pre-test phase to establish technical and face validity, and our feasibility study of the delivery of the

REaCH training to registered health-workers and its cascade to other health-workers, and the perceived impact of training on the delivery of healthcare remotely.

Background: REaCH Training Program and its Development

REaCH training aims to equip health workers with an understanding of the variety, benefits, challenges and organisational changes associated with remote consulting, and the skills for implementation of remote consulting in their healthcare facilities. The training was developed in partnership between St Francis University College of Health and Allied Sciences (SFUCHAS) (Tanzania), King's College London (KCL) (UK), and the University of Warwick (UK). The REaCH training, and a sample presentation of the training materials, can be freely accessed on a not-for profit basis at the Warwick Medical School website [19].

REaCH training, developed in April and May 2020, is designed for registered health workers (e.g. nurses, doctors, clinical medical officers) with access to smartphones, at least intermittent access to Wi-Fi and an ability to learn in English. We refer to these trainees as tier 1 trainees. They engage in self-directed learning using written and video materials. Activities and assignments are included which encourage trainees to apply what they learn to their local context. Training materials are in English and can be downloaded as a PDF where network access is challenging. A facilitator introduces the eight-module course to the trainees and interacts with them via a social media platform to discuss the learning and assignments. Each module is designed to take one to three hours. The facilitator supports these tier 1 trainees to cascade their learning to health workers in their local team (tier 2 trainees) using the train-the-trainer approach. It is left to the discretion of the tier 1 trainees to decide what learning to cascade to the tier 2 trainees. Tier 2 trainees need to own a feature phone (i.e. no internet or up to 2G enabled). In our pilot, the learning cascade was completed in the local language, Swahili.

The content of each module is described in Table 1. REaCH is delivered via Moodle [20], an open-source blended learning app. For the facilitated discussions, in our pilot we used WhatsApp [21] as it was popular locally and content is encrypted; trainees did not share patient information on the group. An information and communication technology officer provided telephone support to trainees when they encountered difficulty with Moodle and suggested solutions when internet access was difficult (such as travelling to a local village to download the materials).

Table 1. REaCH modules

Module	**Description**
Introduction	Why is remote consulting important?
1	What devices and platforms are used in remote consulting?
2	How does my role change and the care I provide my patients?
3	What are the risks and benefits of remote consulting?
4	What patient outcomes can I expect, including limiting COVID-19 spread
5	What new issues arise in remote consulting that are different to face-to-face care?
6	What is my plan for delivering my work remotely (and that of my team/colleagues)?
7	How can I evaluate my own remotely delivered healthcare practice (and that of my team/colleagues)?
8	How can I influence others to change to remote consulting?

We used the TRAIN framework to optimise our train-the-trainers approach [22]. The facilitators who delivered the tier 1 training and the tier 1 trainees themselves were health professionals willing and

able to train others (Talent). We provided airtime and internet for facilitators and each tier 1 trainee received £60 for airtime and internet (Resource). We provided tier 1 trainees with a certificate of course completion so they could add this to their training portfolio (Alignment). Embedded within the REaCH training are teaching and activities related to implementation of remote consulting and how to cascade learning (Implementation). There is opportunity for the tier 1 trainees to maintain contact on social media after the course for peer support (Nurturing).

The facilitator is supported by a facilitator's guide incorporating pedagogical principles underpinning the course, logistics, expectations and tips to optimise trainee engagement. The learner is provided with a guide covering learning expectations, how to seek help, how to organise cascade training and other logistical issues.

In July 2020, we pre-tested the first iteration of the REaCH Moodle course to establish technical and face validity with university-based professionals, eleven from SFUCHAS and one from the UK. The test demonstrated that it was possible and acceptable to use Moodle for delivering the course.

Based on feedback from this test, we included the WhatsApp group for facilitator support, developed the facilitator and trainee guides and notes on how to cascade each module, an introductory video and the option of downloading course materials as a PDF to enable studying to continue when digital access was interrupted. This version of REaCH was used in the second iteration feasibility study (August 2020) described in this paper. During this period, we obtained funding to support the airtime requirements of leaners to undertake and cascade training and deliver remote consultations to their patients. This timeline is presented in Table 2.

Table 2. Timeline: REaCH development, training process and feasibility study

April-May 2020	**Training Development**	REaCH Training developed for online delivery (using Moodle and mobile devices)
July 2020	**Pre-testing**	REaCH training pre-tested with university-based professionals in Tanzania (n=11) and the UK (n=1) Online training delivery mode found to be acceptable
July-Aug 2020	**Adaptation**	REaCH training adapted to include: • Use of WhatsApp • Facilitator & Trainee Guides • Cascade notes • Introductory video • Downloadable materials
Aug-Sept 2020	**Feasibility Study** (as reported in this paper)	REaCH training delivered to 12 tier 1 trainees, Ulanga District. Training completed by 12 trainees. Evaluation completed by 10 trainees.
		Cascade training delivered by 9 trained tier 1 trainers to 63 tier 2 trainees.
Aug 2020-March 2022	**Trial**	Stepped-wedge trial of REaCH training in Tanzania and Nigeria - underway

Indicates data collected and analysed in this paper

<u>Feasibility Study Objectives</u>
To evaluate trainees'

1) Response to REaCH training, their engagement levels and perceptions of the content and process (reaction).

2) Perceptions of their level of understanding of the topic including knowledge, skills and attitudes after undertaking the training (learning).

3) Intended changes in how they deliver healthcare after completing the training and how the training contributed to this (behaviour).

Methods

In this feasibility study we implemented and then evaluated the REaCH training using a survey, qualitative interviews and documentary analysis. Our study was informed by Kirkpatrick's Model [23] for assessing informal and formal learning (Figure 1).

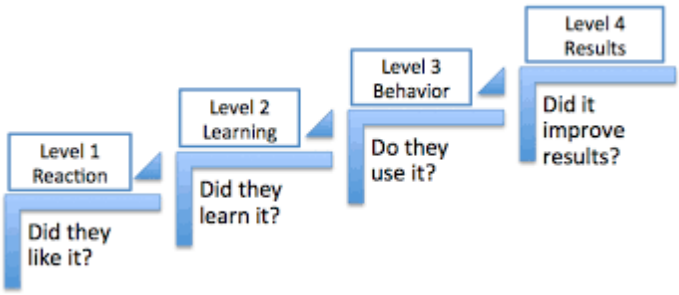

Figure 1. Summary of the four levels of Kirkpatrick's Model [23]

We assessed **reaction**, and self-reported **learning** and intended **behaviour** change.

Ethics Statement

We used the Frascati Definition of Research as summarised by the University of Warwick to determine whether this study was considered research. We considered it not to be research as its purpose was testing and standardisation [24].

We have subsequently checked our decision using the UK Medical Research Council and NHS Health Research Authority tool for assessing ethics review which indicated we did not need ethical review [25].

We received permission from the District Medical Officer (Ulanga District) for the participants (healthcare workers) to participate in the training and its evaluation.

Trainees and Setting

Tier 1 trainees were enrolled from health facilities in the Ulanga District of remote rural Tanzania. Ulanga has a population of 265,203 with one hospital, two health centres and 23 dispensaries [26, 27]. Tier 1 trainees were selected using purposive and referral sampling and fulfilled the following criteria: they consulted with patients, worked in a rural area, owned a smartphone or computer, had access to Wi-Fi, were prepared to include remote consultations by phone as part of their healthcare practice and were willing to cascade training to seven other health workers in their team.

Tier 2 health workers were enrolled by the tier 1 trainees. They had to consult with patients, own a feature phone and be prepared to add remote consultations by phone to their healthcare practice.

The training was delivered between 10th August and 2nd September 2020. All trainees received information about the evaluation and verbally consented to it.

Data Collection

The Survey

Questionnaires were developed by TM and SP for completion by trainees after each module and at the end of the training. These were structured around Kirkpatrick's Model of learning [25] with Kirkpatrick's second and third levels (learning and behaviour) assessed by self-report. We asked trainees about the process of undertaking the training (dichotomous questions, and open-ended questions) and about their satisfaction (reaction), learning and any intended changes to healthcare delivery as a result of the training (behaviour) (5-point Likert scales). A link to the survey was emailed to trainees and completed via Survey Monkey [28].

Qualitative Interviews

The facilitator, all tier 1 trainees who completed the training, and from each of their groups of tier 2 trainees, a convenience sample of two tier 2 trainees, were invited for an in-depth semi-structured interview. These were conducted by telephone following completion of the training by a researcher (TM) experienced in qualitative methods. Interviews explored participants' perceptions and experiences of the training and their views about remote consulting. Each interview was recorded digitally, transcribed verbatim and translated by this researcher.

Documentary Analysis

We collated WhatsApp texts and emails between facilitator and trainees; and reports written by tier 1 trainees after they had cascaded the training to tier 2 trainees. The tier 1 trainees reported on their experiences of cascading training including topic selection, duration of training, preparedness for teaching and learning, how they motivated the tier 2 trainees and advantages and disadvantages of the REaCH Moodle training approach.

Data Analysis and Trustworthiness

The survey results were analysed descriptively. Interview transcripts were independently coded and analysed thematically [29] by three team members (TM, BC, AD). Coding disagreements were resolved through discussion within the wider research team. TM analysed the written documents thematically [29]. The research team held weekly debriefing meetings to reflect on the training and evaluation, identify/respond to challenges, share insights and collectively make sense of the data [30]. We triangulated and integrated our findings in interpretation [31].

Results

Trainees

Twelve tier 1 trainees were enrolled within the REaCH training program, three women and nine men. Tier 1 trainees were predominantly senior medical figures in participating health facilities (mostly doctors, or assistant medical officers). Sixty-three tier 2 trainees received cascaded training. The tier 2 trainees included a variety of health practitioners in the region: clinical officers, nurses, medical attendants, community health workers and pharmacists, as well as three laboratory technicians and two radiologists, who were anecdotally delivering remote consulting. Just under 40% (24 of 63) of tier 2 trainees were women. Trainee characteristics are presented in Table 3. Of the twelve tier 1 trainees, all completed the training, however two faced delays due to difficulty with internet connection and subsequently did not complete the evaluations nor the cascading process. One further tier 1 trainee faced personal circumstances which precluded them from completing the cascading process. Thus, nine tier 1 trainees cascaded their training to tier 2 health workers in their teams (n=63).

Table 3. Trainee characteristics

Cadres	**Tier 1 trainees**			**Tier 2 trainees**	
	Enrolled	**Training completed**	**Training cascaded**	**Enrolled**	**Training completed**
Medical doctors	6	6	5	1	1
Assistant medical officers	5	5	3	2	2
Clinical officers and Assistant clinical officers				18	18
Pharmacists	1	1	1	3	3
Community health workers				2	2
Radiologists				2	2
Laboratory technicians				3	3
Nurses				27	25
Medical attendants				5	5
Gender (F)	3/12	3/12	3/9	24/63	23/61
Total	**12**	**12**	**9**	**63**	**61**

The Survey: Training Process Questionnaires

Survey questions about the process of training were completed by nine tier 1 trainees. Three trainees were unable to complete the survey due to poor internet connection.

All nine responding tier 1 trainees had studied in their own personal time. Seven said that they also studied during working hours. Eight had completed all eight REaCH modules and one respondent completed five modules. All completed the assignments associated with modules studied. Respondents spent between one to three hours studying per module. Of the nine respondents, five completed these modules in the allocated six-day time-frame, while the other four completed it within eight days. Delays were due to busyness, device and network challenges, and initial low technological competence. All respondents found the assistance from the information and communication technology (ICT) officer and facilitators to be effective and timely.

The Survey: Reaction, Learning and Behaviour Questionnaires

Survey questions on reaction, learning and behaviour [23] were completed by 10 respondents (see Appendix 1). There was very little disagreement with the questions. All ten respondents agreed that the training was useful, and that facilitation was sufficient and timely. All ten respondents appreciated the online and WhatsApp method of teaching and found that the learning outcomes were realistic and achievable. Nine out of ten respondents would strongly recommend this type of training to other healthcare workers.

Every respondent reported receiving the skills needed to learn remote consulting and to apply these skills to their jobs. They each reported already using the training in their daily work and being able to train other healthcare workers in this content.

Qualitative Interviews

Telephonic interviews were carried out with the tier 1 training facilitator, nine tier 1 trainees and 16 tier 2 trainees. Interviews lasted between 15-30 minutes each, with tier 1 interviews conducted in English and tier 2 interviews in Swahili. See Appendix 2 for the interview question scaffold.

We present the results under the following themes: perceptions of the REaCH program, challenges encountered during the training, learning from REaCH training, how the training could be improved and trainees' views on implementation of remote consulting into their routine practice. Trainees are labelled according to their tier of training and order in which they were interviewed as follows: Tier 1 - Participant A, B, C…, Tier 2 - Participant AA, BB, CC….

Perceptions of the REaCH Training Program

Overall, the trainees appreciated the program and recommended continuation and expansion among their peers.

- *I wish to congratulate the initiators of this program. I would recommend this knowledge to be taught in the health colleges so that we now begin to recruit new doctors with high experience in remote consultation.* (Tier 1 – Participant D)
- *Generally, the participants perceived the course as a good course, something which is also a success.* (Tier 1 – Facilitator)

Challenges Encountered During the Training

Over half the tier 1 trainees reported challenges with their digital technology, including storage capacity of smart-phones, low technological competence, and network challenges.

- *There is no stable internet connection in this area and this was one of the challenges I faced during the training. Ooh, likewise the mobile network we use in our area is not stable.* (Tier 1 – Participant E)

Nevertheless, trainees found the assistance from information and communication technology (ICT) personnel and facilitators to be effective and timely.

- *There were several technical challenges and some issues concerning the arrangements of the modules, therefore we used to seek instruction from the facilitator and ICT personnel, actually, they were responding as soon as possible. We were told how to download the modules and the way we could go about reading them.* (Tier 1 – Participant A)

While some trainees found it difficult to schedule the training around their work, others appreciated the flexibility of the online training.

- *The shortage of enough time… I spent many hours at work, so I had to make sure I read the modules in my extra time.* (Tier 1 – Participant D)
- *The training time planning was well arranged because it allowed us to engage in learning at any daily time.* (Tier 2 – Participant CC)

Learning from REaCH Training

All participating healthcare workers felt that their knowledge increased and that their behaviour had changed since the training program. Some trainees were learning about remote consultation for the first time.

- *Yes, there are some changes as you know the modules have insisted on practicing remote consultation instead of face-to-face consultation which we only trusted before. Recently we have noticed that remote consultations are also appropriate and actually this alternative will work properly…!* (Tier 1 - Participant E)

Many remarked upon the usefulness of remote consulting during COVID-19.

- *Actually, this would assist much during this time of COVID-19 spread because it avoids the chance for having physical interaction between the patients and doctors.* (Tier 1 – Participant F)

Over half of the interviewees reported paying attention to privacy and confidentiality during remote consultations

- *I do the remote consultation in a professional way by making sure I ask for consent, ensuring privacy as well as keeping their records and making sure I continue to make follow up on the patient's progress.* (Tier 1 – Participant A)

Trainees reported talking to patients before they attended clinic and following them up by phone rather than face-to-face. This included conducting remote consultations for patients who hesitate to attend face-to-face consultations out of fear of stigmatisation.

- *I have started to offer advice to patients with shameful diseases remotely. You know the patients with gonorrhoea can feel free to talk to a healthcare provider remotely rather than face-to-face.* (Tier 1 – Participant H)

Trainees had worked out how to bill for remote consultations.

- *I enjoyed this learning style because I have discovered that through this…this can give us an extra alternative to get money!* (Tier 1 – Participant D)

Recommendations for Improvement of the REaCH Training

Tier 1 trainees recommended a face-to-face meeting at the beginning of the course and additional time at the start to familiarise themselves with Moodle.

- *My advice is this, we should be making face-to-face meetings at least once at the beginning of a course that will be helpful in making things more clear! We can be taught physically on how to go through the Moodle and students' forum as well.* (Tier 1 – Participant D)

The facilitator agreed that additional time was needed at the start of the course for familiarisation and supported the tier 1 trainees in including this during cascading. The facilitator supported some tier 1 trainees in producing printed materials for the tier 2 trainees. However, we found that many of the tier 2 trainees had smartphones and received the online materials easily.

- *The first thing that has been successful in this training, the majority of us received the learning materials on time simply because we have got smartphones through which we received them.* (Tier 2 – Participant MM)

The facilitator was keen to see the addition of incentives to engagement such as accreditation and payment for time spent undertaking the training.

Implementation of Remote Consulting in Routine Practice

To further apply their learning in practice, trainees said they needed airtime and internet packages, suitable electronic devices and improved infrastructure.

- *Our digital devices are not modern ones...we should be assisted with the internet packages to support online processes during the moment of interacting with the remote clients.* (Tier 1 – Participant B)
- *We can't provide the remote consultation if the supporting infrastructures like mobile networks are not working very well. Therefore, the government should ensure all necessary infrastructures for remote consultations.* (Tier 1 – Participant I)

Trainees emphasised the importance of governmental recognition to ensure adequate compensation for their work.

- *This needs some money, workers should be paid for this extra duty.* (Tier 1 – Participant D)

They recognised the need to inform the community about remote consulting.

- *Moreover, we need to make the community be aware and recognise this kind of consultation.* (Tier 1 – Participant I)

The lack of pharmacies and pathology laboratories in rural areas was identified as a barrier to successful remote consulting.

- *First of all, it will be difficult to make a physical examination, and the second challenge will be a shortage of pharmacies in remote areas, something which will make the remote clients fail to get medicines after consultation.* (Tier 2 – Participant CC)
- *The government should allow individuals to establish laboratories in remote areas. You know there are many laboratories that have been stopped due to the fact that they don't meet the eligibility requirements. So we should have enough laboratories in rural areas so that clients may have test.* (Tier 2 – Participant DD)

Trainees noted that some members of the community would not have easy access to a phone as they are owned by the heads of families and sharing phones can reduce confidentiality.

- *You know most of the mobile owners in the family level are heads of the families, therefore the other family members will not be free enough to use those phones. So far, sharing phones will reduce the confidentiality of the clients' information.* (Tier 2 – Participant MM)

Older members of the community were unlikely to afford a phone and there were community members who were illiterate and so unable to use text messaging.

- *Most of the community members, especially elders, are not possessing mobile phones so they can't make consultations by themselves without asking the help from their neighbours.* (Tier 1 – Participant J)
- *Generally, this is a good idea but I am doubting whether the elders will afford to pay the costs for remote consulting* (Tier 2 – Participant NN)
- *So far some of them are not aware of reading and writing, therefore they can't send a text to the doctor when required to do so.* (Tier 1 – Participant J)

Some trainees were concerned with how to keep records of remote consultations.

- *We are still lacking the best alternative to keep the remote clients' records, we should find how to solve this challenge.* (Tier 1 – Participant B)

One said there needed to be a different way of referring patients between healthcare workers when they were consulting remotely.

- *To make referrals to remote clients, there should be an alternative for facilitation referrals from junior to senior HCWs [Healthcare workers]* (Tier 1 – Participant L)

Qualitative findings from the interviews with tier 1 and 2 trainees were compared with analysis of the reports on the cascading process by tier 1 trainees.

<u>Documentary Analysis: Tier 2 Training Process</u>

Tier 2 training was completed over three days, with two pre-training preparation days where tier 1 trainees informed the tier 2 trainees about the aims of the course, its contents, and the training style

and answered any questions. Tier 1 trainees selected modules 1, 2, 3, 5, and 7 for cascade as they were deemed to be the most clinically relevant (Table 1).

Introduction to training occurred via phone conferences and WhatsApp chats, and learning was primarily conducted through smartphone and featured phones with phone calls, texts, phone conferences, WhatsApp message group and emails.

- *Soon after receiving the modules, the (tier 2) trainees started learning independently, when issues could not be understood, they used to make calls and send texts for more discussion and elaboration.* (Tier 1 – Participant E)

Where there were unstable internet connections, tier 2 trainees travelled to their nearest colleagues to pick up the module PDFs or to a nearby area with a stronger internet connection.

- *The participants from the areas with unstable internet connection were advised to move to the areas with internet connection in order to download the materials* (Tier 1 – Participant A)

Of the 63 tier 2 trainees enrolled, 61 trainees completed the course with 53 completing it within three days. Two did not complete due to personal reasons.

- *One participant's child got sick during the week of training that made her fail to complete the training in time.* (Tier 1 – Participant F)

Modifications used to ensure engagement included using reminder texts and phone calls to gauge and maintain attention of the trainees, employing group discussions to increase teamwork, and to conduct face-to-face conversations when the trainees and trainers were working in the same health facilities.

- *Sometimes we were sending texts through the phone and WhatsApp media to remind them about the discussion time.* (Tier 1 – Participant D)
- *I also used to put some question in WhatsApp platform to assess the trainees understanding.* (Tier 1 – Participant F)
- *Participants' charts in WhatsApp assisted to assess the participation rate. You know, we were making calls to (the) training facilitator once per day to report on cascading progress and share the technical experience.* (Tier 1 – Participant B)

Modifications to solve logistical issues included translating the training documents into Swahili to overcome language barriers, providing downloadable materials that trainees could access from nearby villages when they had unstable internet connections, and moving group calls to early morning and evening hours to avoid working hours.

- *All in all, when I posted learning materials on the WhatsApp media, I tried to elaborate in Swahili, to make them understand the contents.* (Tier 1 – Participant A)

Discussion

Principal Findings

This feasibility study has found that remotely delivered professional REaCH training [19] using the Moodle app supported by cascade training infrastructures is technically and pedagogically feasible, and well received by trainees in rural Tanzania. They were satisfied with the course and would recommend the program to other healthcare workers (reaction). They expressed that they learnt skills needed to remotely consult within the health system including how to bill patients for the consultations, and they were able to cascade the teaching (learning). Trainees reported confidently implementing remote consulting and increased understanding of topics such as medical ethics of remote consulting and behaviour change theory (behaviour) [23].

Barriers to remote consulting implementation identified by our trainees include lacking digital infrastructure and few resources, inflexible billing and record-keeping systems, and limited community awareness about remote consulting. Having local technical support for learners proved invaluable to delivery and receipt of training. The greatest immediate barrier to supporting both the upscaling of REaCH training in LMICs and subsequently to the delivery of safe and trustworthy remote healthcare, is the costs of the data or airtime to the health workers themselves.

Comparison to Prior Work

Our REaCH training responds to a need identified by current research. In a systematic review of fourteen studies assessing the feasibility and efficacy of remote consulting in low- and middle-income countries, all studies identified that with adequate training, healthcare workers were able to learn to use mobile phones to deliver healthcare, but the review emphasised that sufficient initial and ongoing training is required to support the implementation of remote consulting [32]. In a systematic review of the barriers to remote consulting, lack of training was likewise identified as a key barrier [33]. Furthermore, during the COVID-19 pandemic, in a survey of physicians in Libya, 638 of 673 (94.8%) of participants expressed willingness to participate in a telemedicine training course [34].

Ediripulge et al.'s literature review of nine studies that described the delivery of training in telehealth not only emphasised the importance of adequate training to ensure integration of remote consulting in health systems, but also found that the programs were predominantly conducted online and were a mixture of continuous professional development and university courses [35].

A scoping review, published after the development of the REaCH curriculum, describes the range of topics covered by courses that train health personnel for remote consulting [36]. Our course covered the key topics commonly taught and included topics less commonly taught including ethics, professionalism, and challenges of remote consulting. In this review only 2/43 studies were conducted in lower middle-income countries [37, 38]. One of these papers, similar to our study, evaluated its program using Kirkpatrick level 3 evaluation, while the other paper also included a Kirkpatrick level 4 evaluation [39, 40].

As in our study, the train-the-trainers approach to remote consulting education was successfully used in Rwanda to train community healthcare workers in monitoring pregnancy and pregnancy-related complications remotely, and in Liberia to upskill traditional midwives to use mobile technology for SMS texting [39, 40]. Also replicated in our findings, remote delivery of remote consulting training in Brazil and India has been successful [38, 41]. These trials and other similar remote consulting training programs in low- and middle-income nations have been well-received with high completion rates, as with our pilot study [42, 43].

Strengths and Limitations

This study has some key strengths. We tested the program at several stages, undertook intensive evaluation at each stage, and were thus able to improve the program multiple times. We collected quantitative data and qualitative data to evaluate the training.

REaCH training and its pilot evaluation was undertaken at speed in response to the urgent need to support Africa's low resource healthcare system in the face of the COVID pandemic. Consequently, it has some limitations. The results are based on a relatively small number of health workers. Kirkpatrick's model informed the evaluation but the second and third levels (learning and behaviour) were assessed by self-report with no external observation or validation. Although Kirkpatrick's model has its limitations for assessing medical education it is useful for an evaluation such as this which assesses immediate effects [44]. The survey questions were developed and delivered in a short timeframe. Although each question captures one area of interest, some include two issues

which we are unable to tease out. There was a marked positive skew in the survey results although in the exploratory semi-structured interviews, respondents talked about both positives and negatives. The evaluation was conducted at one site, a single region in a single country, and by the team who developed the training.

We are currently running a stepped-wedge trial of REaCH training in Tanzania and Nigeria to evaluate actual **behaviour** change and **results** in terms of impact on healthcare delivery [45].

Conclusion

The REaCH program, providing training on remote consulting, is feasible, acceptable and successfully initiated behaviour change in healthcare workers in a rural district in Tanzania. Trainees identified a need for resourcing of data/airtime and a technical and device infrastructure for the implementation of remote consulting.

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Conflicts of Interest

The authors FG, BH, SP and JS have an IP share in the licensing of REaCH training.

Appendices:

Appendix 1: Survey Questions

Appendix 2: Interview Question Scaffold

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Appendix 1: Survey Questions

Survey responses aligned with Kirkpatrick's model (n=10 respondents)

Questionnaire item	**Strongly agree**	**Agree**	**Neither agree/disagree**	**Disagree**	**Strongly disagree**
Satisfaction with REaCH (Reaction)					
Was the learning environment for this self-directed online training conducive for learning?	4	5		1	
Did you like the method and style (pace, online, WhatsApp etc) used to deliver this 'REaCH' course?	5	5			
Was the presentation of the modules engaging and allowing the interaction with other participants?	5	5			
Did you feel the training was useful and worth your time?	6	4			
Were you receiving enough and timely assistance from the course facilitator and information and communications technology personnel during the training?	5	5			
Was it easy to complete the modules, doing activities and assignments?	7	2	1		
Were the learning outcomes realistic and achievable?	7	3			
How REaCH facilitated knowledge & skills (Learning)					
Do you think you have received skills you needed to learn and you can apply them to your job?	5	5			

Did your work environment contribute to your ability to learn?	5	5			
Would you recommend this type of training to other health care workers?	9	1			
	Yes	**No**	**Free text**		
Are they modules you would like to pursue learning further?	7	3	Differences between remote and f2f care; Benefits to patient outcomes; planning for remote care delivery; COM-B model and resistance to change [1].		
Were there any other internal or external obstacles which affected your training?	6	4	Device and internet network; work interruptions; Moodle technical issues		
Did anything noticeable promote your ability to learn during the training?	9	1	Facilitator support; funds for data/airtime; topic importance; peer learning.		
Perceived behaviour change					
Item	**Strongly agree**	**Agree**	**Neither agree/disagree**	**Disagree**	**Strongly disagree**
Can you confidently cascade (train) what you learned to the other health care workers?	6	4			
Are you using what you learned in training in your daily work?	5	5			

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Appendix 2: Interview Question Scaffold

Interview Guide to Tier 1:

Interviewer: Doctor, as I told you, we are going to have a simple discussion concerning ReaCH training. I understand that you are among the trainees who have attended this course, therefore I wish to know your experience concerning this training and so on, welcome!

Process evaluation

I: Please tell me, how did you get engaged in this course?

I: Can you please explain your experience in using Moodle and WhatsApp in this training?

I: Tell us about any changes which required you to use more learning alternatives apart from the planned ones in this training (Moodle and WhatsApp)?

I: Did you make phone calls to your facilitator while learning?

I: How did you interact with your trainer during the learning process?

I: How did you complete your modules and other course-related activities?

I: What are the challenges you may have faced in completing this course?

Reaction and Learning evaluation

I: How was your completion rate, and time spent on this self-directed online training course?

I: In which way did the training address the needs in your role as a health care worker who makes consultations?

I: Did the training style work for you? Consider pace, delivery method, location (in-person or online), content, etc. (how?)

Behaviour evaluation

I: In order to apply what you have learned, what resources or support do you need?

I: Are there noticeable changes in individual and team performance post-training?. (if, yes) Please explain those changes!

I: Think back to prior training. How are you performing in your role now compared to the previous one?

I: Are there any obstacles or challenges that would prevent you from using your new skills efficiently? ***(if yes)*** What are they?

I: What can be done to make you feel motivated to use the new skills you've learned?

I: May you give us your general comments, views or suggestions on this course?

I: Thank you and this is the end of our discussion

Tier 2 Interviews

I: Hello, my name is ……., I am one of the research team members from St. Francis University College for health and allied sciences. I understand that you are among the REaCH course trainees therefore I wish to hear your views concerning this training.

I: Please tell me, what were the biggest strengths and weaknesses of this training?

I: What are three important things you learned from this training?

I: In which way did the training address your role as a health care worker who makes consultations?

I: In order to apply what you learned, what resources or support do you need?

I: Are there any obstacles or challenges that would prevent you from using your new skills efficiently?

I: What can be done to make you feel motivated to use new skills you have learned?