Implementation and Evaluation of an mOral Health Training Program for Community Health Workers in Kenya

A Thesis Presented by

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Abstract

Given the acute shortage of oral health professionals, the WHO Global Strategy for Oral Health adopted at the 75th World Health Assembly recommended the development and implementation of workforce models that enable sufficient numbers of adequately trained, motivated, and well-distributed health workers to provide oral health services through a collaborative and interprofessional network. The Consortium of Universities for Global Health (CUGH) provided guidance on competency-based oral health education and in 2023, the Harvard School of Dental Medicine in partnership with the WHO-AFRO developed the first competency-based m-oral health curriculum designed specifically for CHWs in Africa. This study evaluates the effectiveness of the pilot implementation of the mOral health curriculum in preparing CHWs to deliver oral health care to underserved communities and identifies barriers and facilitators to implementing the training program to inform future scalability.

A mixed-methods evaluation was conducted using a convergent parallel design. Quantitative data were obtained from the OpenWHO platform, and a structured course feedback survey was distributed to all registered course participants in English, French and Portuguese through the platform. Qualitative data were collected through focus group discussions with CHWs and designated trainers (DTs) selected through purposeful sampling in four pilot counties in Kenya. Observational data collected through participation in planning meetings and digital ethnographic analysis of stakeholder discussions, were used to triangulate findings and assess implementation dynamics. Descriptive statistics were applied to quantitative survey data, while qualitative data were thematically analyzed to identify key facilitators and barriers to implementation.

The online course enrolled 5,957 learners globally, with 2,403 earning a record of achievement. The feedback survey in English received 371 responses, French had 123 responses and Portuguese had 46 giving us response rates of 6.2%, 10.9% and 8.9% respectively. Survey responses demonstrated high engagement, with 90% of participants affirming the course's relevance to their work. A total of 1,265 CHWs and 39 DTs participated in the pilot implementation in Kenya. Focus group discussions were conducted with 40 CHWs (10 from each county) and 18 DTs. Qualitative findings highlighted the program's success in addressing a critical knowledge gap, increasing CHW confidence in oral health promotion, and fostering interprofessional collaboration and quantitative findings confirmed their high satisfaction with the course curriculum and features. Implementation challenges included digital access barriers, insufficient logistical and financial support, and highlighted gaps in integration of CHWs into formal referral systems.

The study provides evidence supporting the feasibility of integrating CHWs into oral health service delivery through digital training. Key facilitators included the flexibility of the online format, the effectiveness of the mOral health curriculum, and the strong peer support networks among CHWs and DTs. Challenges such as technological barriers, and a lack of formalized referral pathways must be addressed for effective scale-up. While Kenya had a strong strategic plan that guided this work with highly engaged stakeholders, strengthening implementation through strategic policy support, provision of offline training resources, and sustainable funding mechanisms will be critical for expanding this model across other low and middle income settings. These study findings contribute to the broader discourse on workforce capacity-building and the role of digital learning in advancing universal health coverage.

Author's Contribution Statement

This dissertation is based on a multi-phase project initiated through a 2021 agreement between the World Health Organization (WHO) and the Harvard School of Dental Medicine (HSDM) to develop and implement a competency-based m-Oral Health curriculum for community health workers in Africa.

In Phase 1, Dr. Brittany Seymour served as the Principal Investigator (PI) for the course development phase, during which I contributed as one of her mentees. In Phase 2, I assumed the role of PI, leading the pilot implementation and evaluation of the course in Kenya. As PI, I led the development of the implementation work plan and coordinated the collaborative partnership that included stakeholders from WHO-AFRO, the Kenyan Ministry of Health, and the University of Nairobi. I was primarily responsible for project coordination, obtaining ethical and local review clearance, developing evaluation tools, overseeing data collection and analysis, and reporting findings.

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My heartfelt gratitude extends to my advisory committee members—Dr. Donna Hackley, Dr. Fernando Reimers, and Dr. Shenam Ticku—whose insightful feedback over the past two years have been instrumental in shaping this work. I am also profoundly thankful to my department chair, Dr. Catherine Hayes, whose mentorship has been a guiding force in my career.

This project would not have been possible without the collaboration and support of our partners at the Kenyan Ministry of Health. I am especially indebted to Dr. Penny Muange, Dr. Miriam Muriithi, and Dr. Consolata Machila for their commitment and contributions to this work. I also extend my sincere gratitude to the designated trainers and community health workers in Kenya, whose participation and dedication brought this project to life. I am also grateful to the OpenWHO team Ana Mafalda and Corentin Piroux for their continuous support.

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Introduction

Background

Globally, oral disease significantly adds to noncommunicable disease (NCD) burden, with over 2.4 billion people suffering from untreated caries, and oral cancer being one among the ten most common cancers[1]. The foremost impact is chronic pain, loss of work and/or school days, continuous infection of the mouth, feeding issues, and overall reduced quality of life. These diseases are closely related to systemic health, and they bear great importance with a substantial burden on public health[2].

Adequate response to this challenge requires integrated and collaborative preventive approaches. However, the WHO estimates that by 2030, there may be a projected shortfall of 10 million health workers, including oral health workers, mainly in low- and lower-middle-income countries[3]. The sub-Saharan African region has a particularly low ratio of oral health professionals, with only 0.44 dentists per every 10,000 people, which is far lesser than the global ratio of 3.3 per 10,000 people[3].

Given the acute shortage of oral health professionals, the WHO Global Strategy for Oral Health adopted at the 75th World Health Assembly recommended the development and implementation of workforce models that enable sufficient numbers of adequately trained, motivated, and well-distributed health workers to provide oral health services through a collaborative and interprofessional network[4]. Existing evidence supports a tiered health workforce, beginning with disease prevention and health promotion by community-level workers, followed by primary care providers, and finally by treatment delivery through highly skilled dentists and specialists. This tiered structure is known as the primary health continuum [5,6].

Oral health care has not typically been a component of the training provided to community health workers (CHWs), and in several countries, inadequate attention is given to planning and implementation of the training of CHWs[4]. To address this gap, the WHO Global Strategy on Human Resources for Health: Workforce 2030 emphasized the strategic use of digital technologies to deliver e-training for workforce development, as part of the WHO's global mHealth initiative[7]. The WHO Workforce document also emphasized the need for accelerating progress towards universal health coverage (UHC) through the development of strategic workforce objectives to meet the needs of communities. Globally, there has been a high adoption of technology tools and e-learning has the potential to reach population groups in remote and low-resource settings or where barriers to accessing high-quality healthcare education exist[8]. There is also growing evidence that technology including digital platforms and messaging features have become salient technological features to address health needs.[9,10] The use of this technology to make health education more accessible supports U.N. Sustainable Development Goal #4 toward ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all[10]. To ensure the delivery of high quality training, in 2011, the consensus statement of the WHO Bellagio eHealth Evaluation group highlighted the importance of rigorous evaluation of eHealth to generate evidence and promote the appropriate integration and use of technologies[11]. The Consortium of Universities for Global Health (CUGH) provided guidance on competency-based oral health education[12] and in 2023, the Harvard School of Dental Medicine in partnership with the WHO-AFRO developed the first competency based m-oral health curriculum designed specifically for CHWs in Africa [3].

The CUGH competency subcommittee specifically recommended that the next step in competency-based curricular training is to identify suitable evaluation and implementation practices [13,14] . This paper describes the implementation and evaluation of this oral health curriculum in Kenya.

A lower-middle-income country (LMIC) in Sub-Saharan Africa, Kenya is among the 57 nations identified by the WHO as facing a severe shortage of healthcare workers[15]. The demand for oral health services in the country has consistently exceeded the available workforce, which includes dentists, community oral health officers (COHOs), and dental technologists (DTs). Kenya's healthcare system is organized into six tiers, ranging from community-based care to national referral hospitals[16]. At the foundation is Tier 1 (Community Health Services), which consists of Community Health Units (CHUs) led by Community Health Workers (CHWs) who provide basic preventive, promotive, and some curative services at the household level. Tier 2 (Primary Care Facilities) includes dispensaries and clinics that offer outpatient services, immunizations, and basic maternal and child health services. Tier 3 (Primary Hospitals) consists of health centers and sub-county hospitals, providing inpatient care, minor surgeries, and more specialized outpatient services. Tier 4 (County Referral Hospitals) serves as the first level of referral, offering specialized medical care within each county. Tier 5 (Regional Referral Hospitals) are high-capacity hospitals that provide advanced diagnostic, surgical, and specialist services, catering to multiple counties. At the highest level, Tier 6 (National Referral Hospitals) consists of institutions which offer the most specialized and highly advanced medical care, including training and research.

Dentists, who make up the majority of oral health professionals, serve as the primary providers of dental care in the country. Most dental facilities are located in tier 3 or higher, and community based centers and primary care facilities provide limited to no oral health services[17]. As of 2020, Kenya had a total of 1344 registered dentists in the country, and in 2022, Kenya was reported to have a dentist-to-population ratio of 0.26 per 10,000, far below the global average of 3.3:10,000 [18,19].The WHO Global Oral Health Action Plan, set an ambitious goal for 80% of countries to have an operational national oral health policy, strategy, or action plan by 2030[4]. In 2022, the Ministry of Health in Kenya released the Kenya National Oral Health Strategic Plan 2022-26 that outlined the current status and created a roadmap for improving the oral health of Kenyans through key actions like developing infrastructure, enhancing data collection, and promoting eco-friendly practices[17]. The strategic plan specifically outlined a strategy in Action 3 “To train and equitably distribute human resource for oral health” that included steps to strengthen oral health workforce capacity by addressing training and deployment gaps, enhancing integrated disease prevention, improving health records management, and developing instructional materials for primary care integration. As of 2023, Kenya had a smartphone penetration rate of 61%, with roughly 30.8 million people in the country gaining access to smartphones[20] making the m-oral health curriculum implementation a feasible option to train CHWs in the country. The implementation of our online training program tied in well to these previously established strategic goals and the tiered health workforce model, making Kenya an optimal choice for the pilot implementation of the program.

Significance and hypothesis

This innovative pilot implementation in Kenya and its evaluation is leading the way globally in directly supporting progress toward universal health coverage, the interprofessional agenda for control and prevention of NCDs, and competency-based education approaches in workforce development and capacity building through the integration of oral health training for CHWs. CHWs in Kenya previously did not receive oral health education or training of any kind, making the implementation of the curriculum the first step in an attempt to integrate oral health in primary health care delivery. This pioneering project is the first of its kind in the region and supports the essential next steps of this work to develop research-based instructional practices (RBIPs) for curriculum delivery that best preserves its validity and fidelity for scale. Our study aims to determine if adding an mOral health training curriculum prepares CHWs to deliver contextually appropriate oral health care as part of the basic package of services to communities that are otherwise not receiving care. We also identify implementation barriers and facilitators that can inform scaling of the mOral health training curriculum in other regions.

Methods

Approach

The overall design followed the well-established Kern's Six Step Model of Curriculum Development[22] which included the following steps: Step 1- problem identification and general needs assessment, Step 2- targeted needs assessment, Step 3- goals and objectives, Step 4- educational strategies, Step 5- implementation and 6- evaluation, feedback, and revision. Detailed information regarding phase 1 of this project including steps 1-4 can be found in Appendix A however these steps have been summarized below to provide context for steps 5 and 6 that are central to this study.

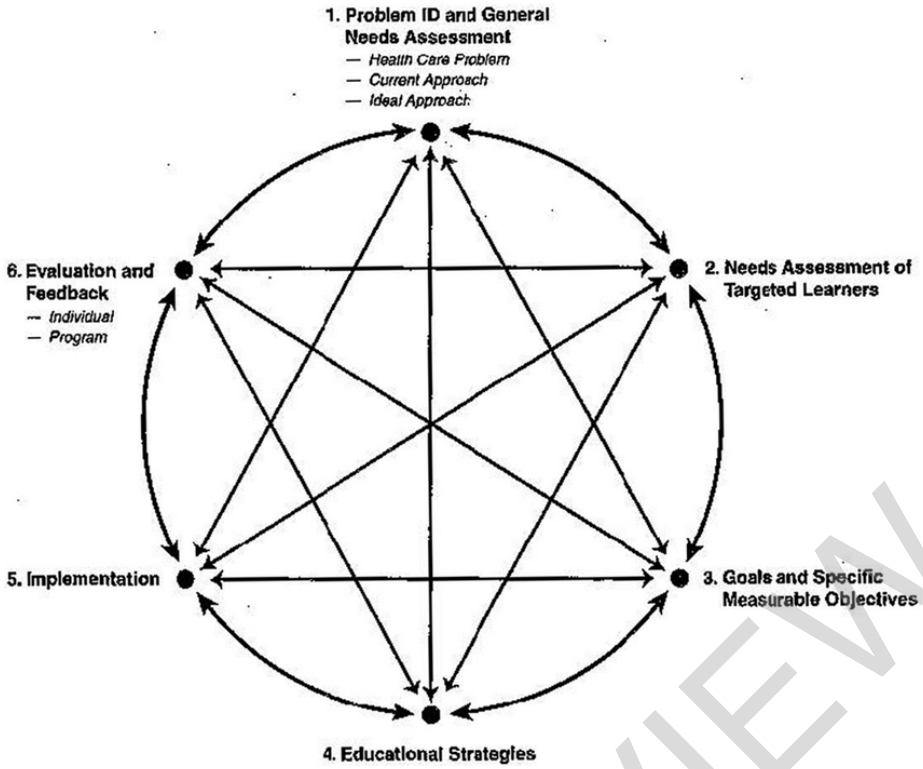

Figure 1: David Kern's six step model for curriculum development
Source: Kern, David E., M.PH., Patricia A. Thomas, M.D., Donna M. Howard, R.N., Dr.P.H., and Eric B. Bass. Curriculum Development for Medical Education: A Six-Step Approach. p.6, Figure 1.1. © 1998, 2009 The Johns Hopkins University Press.

Step 1: Problem Identification

This step involved conducting a general needs assessment to define the core problem and ensure an inclusive, stakeholder-driven approach. Four pilot countries—Angola, Kenya, Liberia, and Senegal—were preselected by the WHO Regional Office for Africa to support curriculum development. Expert stakeholders, including representatives from ministries of health, regulatory bodies, healthcare professionals, and community leaders, were engaged in all aspects of curriculum design. The process was informed by multiple evidence-based WHO guidelines and reports mentioned previously, on oral health promotion, community health worker training and workforce development, and childhood dental caries prevention.

Step 2: Targeted Needs Assessment

Step 2 focused on refining project aims and developing a competency-based mOral Health training for Community Health Workers (CHWs) based on stakeholder input. Four virtual focus groups—one per pilot country—helped synthesize literature, assess competency frameworks, and shape curriculum development. A project workbook was created, covering curriculum themes, competencies, CHW education levels, and learning environments, with stakeholders contributing context-specific insights. A half-day virtual Stakeholder Workshop followed, bringing together key representatives from ministries, professional associations, funders, and WHO regional offices to discuss barriers, facilitators, and finalize the curriculum's scope and content.

Step 3: Goals and Objectives

This step focused on defining goals for integrating oral health training into existing CHW programs, detailing competencies, measurable learning objectives, and the selection and preparation of Designated Trainers (DTs). Stakeholders emphasized that CHW selection should align with task complexity, community acceptance, and formal certification by relevant authorities. They identified key competency themes, including preventive services, social determinants of health, and integration into healthcare systems. Competency-based education frameworks, including WHO guides and the 2015 Competency Matrix for Global Oral Health, informed the curriculum's structure to ensure integration of this curriculum into existing trainings rather than serve as a siloed standalone curriculum. Stakeholder recommendations also included a blend of in-person and virtual learning, supervised practical experiences, and adaptable content for diverse literacy levels. DTs—drawn from oral health personnel, nurses, midwives, or community health assistants—would be responsible for mentoring, assessing, and certifying CHWs, ensuring the curriculum remains accessible, adaptable, and aligned with local needs.

Step 4: Educational Strategies

In this step, the group finalized curricular content, pedagogy, and evaluation through stakeholder input once again. The five-module mHealth training, that was hosted on OpenWHO from July 1, 2023, through January 6th, 2025, included downloadable presentations, narrated videos, and regionally relevant graphics. Narration was provided by local speakers in collaboration with Harvard's Center for African Studies.

Competency-based assessments were developed that included module quizzes that required an 80% to pass, which is an OpenWHO standard, and a case-based summative exercise was developed to be delivered by Designated Trainers (DTs). An answer key is provided and learners who fail would receive remediation before reattempting.

The course materials were professionally translated into English, French, and Portuguese for accessibility and OpenWHO's offline-friendly format ensured flexible learning. Upon completion of the online course, learners automatically receive a Record of Achievement, and a final certification is granted after the in-person summative assessment by the DT. A summary of the module content, competencies, learning objectives and integration options can be found in Appendix B.

Step 5: Implementation

<u>mOral health training course launch:</u>

The English version of the online course was launched in July 2023, in conjunction with the launch of the WHO's Global Oral Health Action Plan 2023-30, on the OpenWHO platform hosted by the WHO. Subsequently, the translated versions of the course in Portuguese and French were also launched on OpenWHO. The global launch of the course took place on July 7th, 2023, through a live webinar during which the PI of the course development phase, Dr. Brittany Seymour, introduced and demonstrated the online course. A panel consisting of members from the AFRO Health Workforce team, the Chief Dental Officer from Senegal, the Director General for Health, Ministry of Kenya, the WHO HQ Oral Health Program Officer, and an academic partner from University of Montpellier, France then discussed how to utilize this course as part of health system strengthening efforts.

Logic model:

A logic model was one of the key elements in guiding the design of this program. The model (Figure 2) illustrates the relationship between existing resources that informed and supported the program's main activities as well as the associated outputs. It also documents how the implementation and evaluation activities fit between the development and scaling phases of the overall project. The logic model was initially developed at the start of the curriculum development in 2021 and evolved to adapt to the changing circumstances through regular updates as the project progressed.

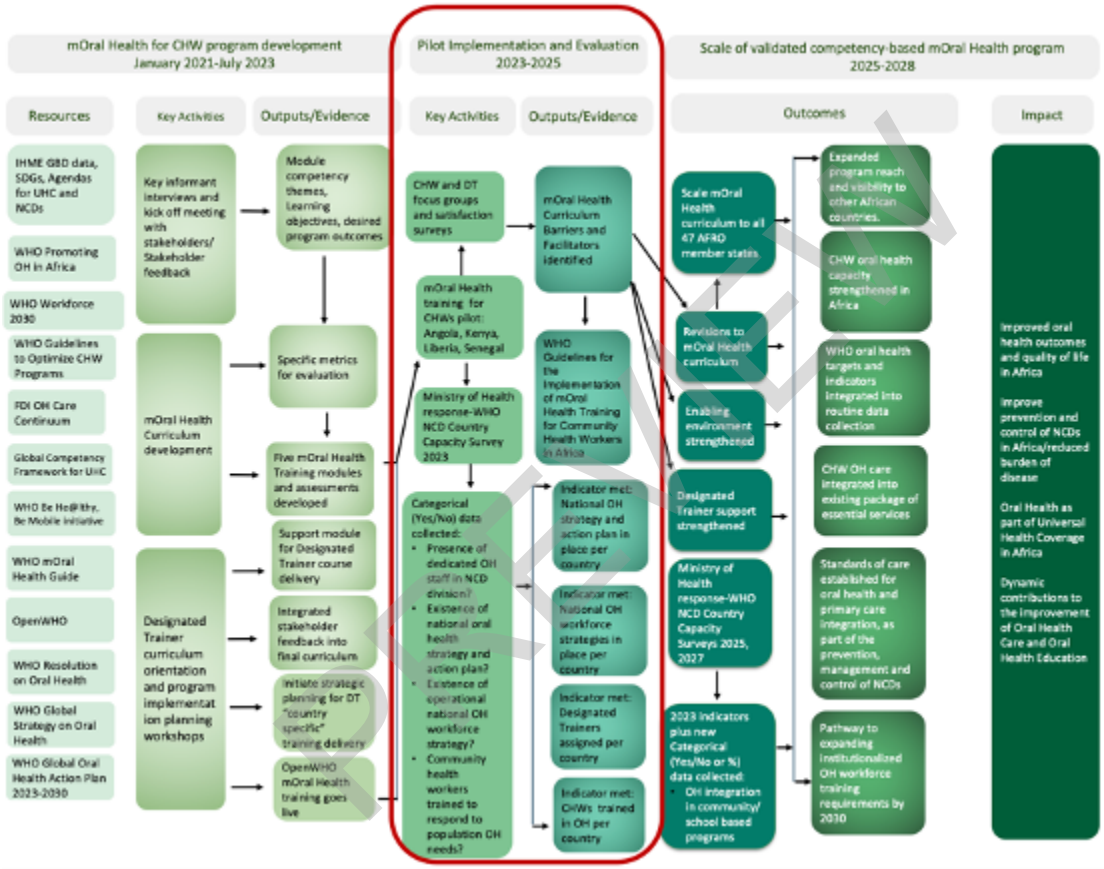

Figure 2: *Logic Model depicting the overall competency-based mOral health curriculum development and implementation plan. Circled in red is the phase of the overall project described in this manuscript.*

Pilot Implementation

Kenya was chosen by WHO-AFRO to be the pilot country for implementing this training curriculum. The collaboration between the Harvard School of Dental Medicine (HSDM) and WHO AFRO established in January 2021 was maintained for this part of the project. The implementation plan was developed through a collaborative effort by the implementation support team that consisted of oral health researchers at HSDM, the Ministry of Health oral health

officers in Kenya, academic partners from the University of Nairobi and the WHO regional office in Kenya. This collaboration was established and supported by the WHO regional office for Africa Technical Officer, Dr. Yuka Makino and regularly scheduled planning meetings were held between July 2023 through June 2024 to discuss the steps for implementation. The key activities for the pilot implementation phase, as described in the logic model, included weekly meetings of the primary investigator with the implementation support team to plan the training implementation and evaluation activities. The Kenyan National Oral Health Strategic Plan 2022-26 was an important resource as documented in the logic model and was instrumental in assessing the presence of dedicated oral health staff and the existence of an operational oral health workforce strategy in Kenya. The plan outlines six key action areas to address challenges related to oral health, including strengthening governance, promoting preventative measures, training healthcare workers, improving health systems, and encouraging eco-friendly practices. The plan also specifically outlines the importance of engaging the community in planning, implementation, and monitoring of appropriate oral health programs and outlines strategies to coordinate the efforts and agenda of several stakeholders in line with country wide NCD, PHC and UHC priorities and promoted training, recruitment and retention of required oral health workers and their distribution in the communities that had the most need. Given its alignment with the objective of this implementation, this document served as a primer for the Ministry of Health as well as for external collaborators to assess the current status and guided the planning of implementation activities.

After initial discussions with the implementation support team to clarify program objectives and goals, the ministry of health staff developed a Tripartite Working Group (TWG) consisting of the representatives from the County Health Management Team (CHMT) that included community oral health officers and focal persons. The chief dental officers (CDOs) were identified to oversee the implementation of this pilot project at the national level and build the capacity of designated trainers. CDOs conducted orientation workshops to orient the TWG to the mOral health training program and the competency-based approach for training CHWs. The overall purpose of the workshops was to initiate strategic planning on curriculum orientation to enable these stakeholders to feel prepared to integrate oral health into their existing CHW training programs. Officials also shared lessons learned from previous CHW trainings and conducted group activities to reach consensus on the road map for implementation. The roadmap agreed on by the TWG is attached as Appendix C. The Ministry of Health in partnership with the Kenyan Dental Association and WHO-AFRO also developed a brochure (Appendix D) to summarize the implementation of the program that described the roles of each of the stakeholders and this brochure was distributed to all participants to ensure sensitization to the program. A group chat was created on Whatsapp Messenger, Meta™, a common social media app used for communication in the region[21], to facilitate easy communication between the TWG members and the primary investigator.

Inclusion criteria

The MoH staff identified 4 counties in different regions of Kenya to implement the program. These are Nairobi, Kiambu (Central), Kakamega (Western region) and Tharaka Nithi (Upper Eastern region). Funding support for implementation activities for Tharaka Nithi,

Kakamega and Nairobi was provided by WHO-AFRO while the implementation in Kiambu was supported by the Kenyan Dental Association (KDA) using funding from the World Dental Federation (FDI). These 4 counties provided a representative mix of urban and rural settings. Nairobi has 17 sub counties, Kakamega 12 sub counties, Tharaka - Nithi 6 sub counties and Kiambu 12 sub counties and all sub-counties were included in the program. One Community Health Unit (CHU), which is composed of 1 Community Health Assistant (CHA) and 10 CHWs under their supervision, were chosen per sub - county under the guidance of the County Health Management Team (CHMT). Each CHW is responsible for 100 households, and the educational background of CHWs range from elementary education to diploma level.

In phase 1 of this project, the DT guide recommended that workforce personnel who currently train and supervise community workers should be selected as designated trainers. In keeping with this, the designated trainers (DT) identified in Kenya included dentists and Community Oral Health Officers (COHOs) and they were selected by the Kenyan Ministry of Health and community health focal persons from each county to ensure representation from various communities and healthcare settings.

Program implementation

A train-the-trainer model was employed to sensitize the identified DTs, and assigned members of the TWG led these sessions with DTs of their respective counties to ensure consistency in their orientation. After sensitization to the purpose of the program, DTs were given access to the DT module of the mOral Health training program to prepare them to train the CHWs. The course was introduced to CHUs by the DTs in an orientation session and a pre-test assessment was conducted to obtain baseline knowledge of the CHAs and CHWs. Participants were then given 2-4 weeks to complete the online training course and obtain the certificate of completion. The Oral Health Officers at MoH were able to obtain support from Safaricom PLC, a regional telecommunication provider, to whitelist the course website that provided unlimited free access to it for anyone located in Kenya. Once the CHAs and CHWs completed the online course, the DTs scheduled an in-person training to contextualize the oral health information and, on completion of the training, the summative assessment developed in step 4 referenced above was conducted by the DTs. A post-test assessment was also administered by the DTs to compare against the baseline assessment to check the participants' knowledge.

Step 6: **Evaluation & Feedback**

We employed a well-established tool, the Internal Coherence Assessment Protocol (ICAP) framework[24], to guide the evaluation of the online training program. The ICAP framework focuses on three common patterns of organizational features associated with an institution's capacity to improve: leadership focused on the support for instructional improvement, individual and collective efficacy beliefs of faculty related to instructional practice and student learning, and the whole institution and team-level organizational structures and processes that support improved instruction and student achievement over time. The factors from this framework were constructed into three domains: curriculum and innovation, educator and learning[23], and institutional and structural and are summarized in Table 1.

Table 1. *Theoretical factors that serve as implementation barriers and facilitators across three domains: Curriculum, Educator and Learner, and Structural*.

Curriculum Factors	**Educator and Learner Factors**	**Structural Factors**
Materials	Need	Competing priorities
Format	Motivation	Resource constraints
Accessibility	Resources	Enabling environment
Compatibility	Mandates	Norms
Complexity	Capacity	
Quality	Outcomes	

The application of these factors in the development of our evaluation questions and measures has further been summarized in Table 2 below. Ethical review was overseen by the Harvard Longwood Campus Institutional Review Board (HLC IRB23-1280) and the project was determined to be not generalizable human subject research thereby exempting it from a full review. Local ethical review clearance was also obtained from the University of Nairobi's Ethical Review Committee (ERC approval number: P882/12/2023). Additionally, a license was obtained from the National Commission for Science, Technology and Innovation (NACOSTI: License No: NACOSTI/P/24/34043) to permit the primary investigator to conduct research activities in Kenya.

Table 2. *Association between the Internal Coherence Assessment Protocol (ICAP) and Developmental Framework to support the development of survey instruments, interview guides and assessments to identify factors in each of the three domains.*

Domain	**Questions**	**Data source**	**Measures**	**Application**
Curriculum/ Innovation Factors	Is the quality and availability of the curriculum materials appropriate? Does it address a gap in CHW knowledge? Are there other programs for CHW oral health capacity building?	Course evaluation surveys; CHW and DT focus groups and interviews	Initial satisfaction with curriculum accessibility, quality, and content; CHW learning outcomes	To improve curriculum format and organization within the broader CHW training environment, for our early adopters, and ultimately for all users

Educator and Learner Factors	What is the perceived need of the curriculum? Are CHWs and designated trainers motivated to participate? Were CHWs able to effectively access the online curriculum? Were designated trainers able to effectively deliver the in-person curriculum? Were CHWs able to acquire new knowledges, skills, values? Are CHWs more confident in oral health content?	Course evaluation surveys; CHW and DT focus groups and interviews; formative and summative assessments*; designated trainer adherence to curriculum and assessment design	CHW efficacy in achieving competencies and applying new knowledge, skills, and values in practice; DT efficacy in training delivery and CHW supervision and assessment	To improve curriculum content, format, and organization; to demonstrate overall impact on DT training, CHW learning, and self-efficacy for both
Institutional and Structural Factors	What is the impact of the new curriculum? Was implementation supported nationally? Were problems identified early and addressed efficiently? Were there sufficient resources provided? Was success recognized and shared?	Structured interviews with oral health/NCD division leadership and DTs*; *Ministry of Health response- WHO NCD Country Capacity Survey 2023	Organization and leadership advocacy, support, accommodation, facilities, and recognition for curriculum innovation Presence of dedicated OH staff in NCD division; Existence of national oral health strategy and action plan; Existence of operational national OH workforce strategy; Community health workers trained to respond to population OH needs	To strengthen and enabling environment for mOral Health; to document and improve implementation process of the curricular innovation; to inform future change efforts; to inform new Categorical (Yes/No or %) data collected by the WHO NCD Country Capacity Survey: OH integration in community/ school based programs

*CHW=community health workers, DT=designated trainers *Not available at the time of this study.*