

# Development, Testing, and Implementation of a Training Curriculum for Nonphysician Health Workers to Reduce Cardiovascular Disease



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## ABSTRACT

**Background:** Cardiovascular disease (CVD) is the leading cause of death worldwide. The need to address CVD is greatest in low- and middle-income countries where there is a shortage of trained health workers in CVD detection, prevention, and control.

**Objectives:** Based on the growing evidence that many elements of chronic disease management can be shifted to nonphysician health care workers (NPHW), the HOPE-4 (Heart Outcomes Prevention and Evaluation Program) aimed to develop, test, and implement a training curriculum on CVD prevention and control in Colombia, Malaysia, and low-resource settings in Canada.

**Methods:** Curriculum development followed an iterative and phased approach where evidence-based guidelines, revised blood pressure treatment algorithms, and culturally relevant risk factor counseling were incorporated. Through a pilot-training process with high school students in Canada, the curriculum was further refined. Implementation of the curriculum in Colombia, Malaysia, and Canada occurred through partner organizations as the HOPE-4 team coordinated the program from Hamilton, Ontario, Canada. In addition to content on the burden of disease, cardiovascular system pathophysiology, and CVD risk factors, the curriculum also included evaluations such as module tests, in-class exercises, and observed structured clinical examinations, which were administered by the local partner organizations. These evaluations served as indicators of adequate uptake of curriculum content as well as readiness to work as an NPHW in the field.

**Results:** Overall, 51 NPHW successfully completed the training curriculum with an average score of 93.19% on module tests and 84.76% on the observed structured clinical examinations. Since implementation, the curriculum has also been adapted to the World Health Organization's HEARTS Technical Package, which was launched in 2016 to improve management of CVD in primary health care.

**Conclusions:** The robust curriculum development, testing, and implementation process described affirm that NPHW in diverse settings can be trained in implementing measures for CVD prevention and control.

Noncommunicable diseases (NCD), including cardiovascular disease (CVD), cancer, respiratory illnesses, and diabetes result in 40 million deaths each year [1]. Among NCD, CVD alone is responsible for an estimated 17.7 million deaths, making it the most common cause of death around the world [2]. In response to this growing crisis, the United Nations' 2030 Agenda for Sustainable Development recognized NCD as a major challenge to sustainable development and urged member countries to commit to developing national responses to reduce premature NCD deaths by 30% by the year 2030. In 2013, the World Health Organization (WHO), in consultation with the World Heart Federation and other organizations,

developed the "Global Action Plan for the Prevention and Control of NCDs 2013–2020," which includes 9 global targets that have the greatest impact on NCD mortality [3].

Achieving these global targets requires the development and implementation of collaborative and coordinated programs across different settings. The need is greatest in low- and middle-income countries (LMIC), where more than three-quarters of global NCD deaths occur [1]. Addressing CVD in LMIC and resource-constrained settings in high-income countries (HIC) requires a combination of low-cost evidence-based medications (antihypertensives and statins), along with effective and sustainable population-wide interventions that target CVD risk factors such as

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tobacco, lack of physical activity, unhealthy diet, and harmful use of alcohol [4–6]. Delivery of these interventions is important in primary health care, which provides the most appropriate setting for task-shifting.

Experience in LMIC shows that many elements of chronic disease management do not require the expertise of highly trained physicians and alternatives to the physician-centered model of CVD control can be implemented successfully. For example, the Asset-Based Community Development (ABCD) model considers locally trained nonphysician health care workers (NPHW) as critical players in improving the health status of their communities [7]. The training of NPHW, which can range from village volunteers to nurse practitioners, is part of a wider initiative on task-shifting supported by WHO, where NPHW are trained to take on more responsibility in the diagnosis, treatment, and management of many chronic conditions (Figure 1). Furthermore, task-shifting is a proposed strategy in some of the World Heart Federation roadmaps, such as secondary prevention, atrial fibrillation, and raised blood pressure.

Although many successful task-shifting efforts have focused on infectious diseases such as malaria, tuberculosis, or human immunodeficiency virus/acquired immunodeficiency syndrome [8,9], there is growing evidence available to suggest that task-shifting within the context of CVD can be just as successful [10–14]. Recognizing a need to further evaluate task-shifting initiatives, coupled with health system strategies to address the growing burden of CVD, the HOPE-4 (Heart Outcomes Prevention and Evaluation–4) program has developed, pilot-tested, and implemented an NPHW training curriculum in Colombia, Malaysia, and Canada to diagnose, manage, and control CVD risk [15]. Communities in Malaysia and Colombia were chosen based on previous population-based studies that highlight a shortage of physicians, especially in rural

areas and the public sector along with poor blood pressure control among populations at risk. In Canada, communities were targeted as part of existing community health promotion programs in the inner city. The overall objective of the HOPE-4 study is to develop, implement, and evaluate an evidence-based, contextually appropriate program for CVD assessment, treatment, and control. The curriculum is a component of the larger HOPE-4 program and laid the foundation for the current primary health care worker training curriculum in the WHO's HEARTS Technical Package (Figure 2) [16]. We describe the development of the HOPE-4 NPHW training curriculum, testing results from the implementation process, as well as adaptation to the HEARTS Technical Package.

## METHODS

### Curriculum Development

The standardized NPHW training curriculum for the assessment, management, and control of CVD was developed by the Population Health Research Institute with input and support from WHO. The interdisciplinary team responsible for developing the curriculum consisted of 2 masters in global health students, a cardiologist and knowledge translation researcher, a clinical epidemiologist, and a dietician. A phased approach to curriculum development began with defining the need for a curriculum and culminated in a comprehensive, 9-module training program for NPHW. Ongoing input from participating stakeholders, including health care providers, clinical researchers, and NPHW in Colombia, Malaysia, and Canada was encouraged throughout the curriculum development phases. The feedback from the stakeholders occurred at 2 points specifically. During the development process, stakeholder involvement was used to design the modules and incorporate local perspectives on topics such as diet and physical activity. After developing the curriculum, stakeholder feedback was used to overcome logistical and NPHW training challenges.

Phase 1 focused on defining the need for a standardized curriculum across a variety of settings. The decision to develop this curriculum with the ultimate goal of training NPHW follows 2 decades of research collaborations attempting to target CVD globally [17]. In defining this need, we concluded that a standardized approach that includes “fixed” and “adaptable” elements in the training curriculum would facilitate implementation across diverse settings. The fixed components of the curriculum were identified as the evidence-based diagnosis, treatment initiation, and achievement of blood pressure (BP) control targets whereas adaptable components include counseling techniques, cultural differences, and teaching styles appropriate to local settings. Based on identified gaps in BP detection, management, and control identified in the PURE (Prospective Urban Rural Epidemiology) study, BP has been identified as a target for the intervention and evaluation in the wider HOPE-4 intervention.

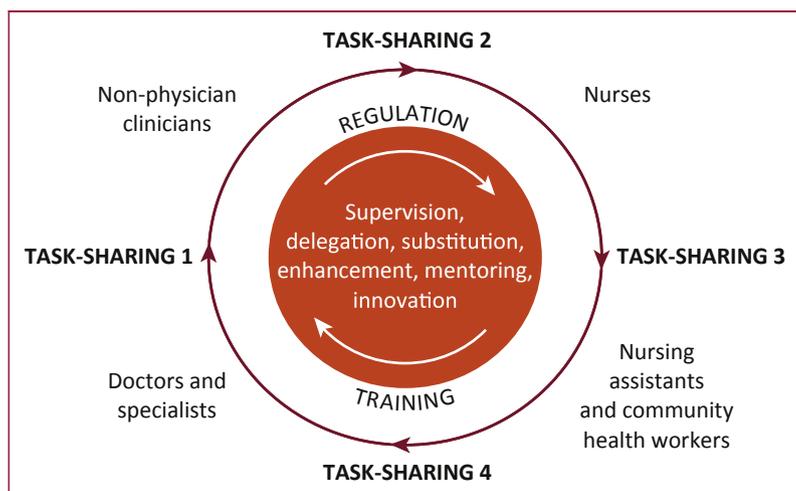


FIGURE 1. Task-sharing to expand the pool of human resources for health. Reproduced with permission from World Health Organization [16].

Phase 2 involved a literature review of existing task-shifting curriculums and treatment guidelines. In reviewing existing documents and publications, we identified 3 key limitations that were addressed in the HOPE-4 curriculum. First, the recommendation to initiate treatment after multiple elevated BP readings [18,19] is inefficient in low-resource settings where individuals may not be prepared to travel to clinics multiple times for BP measurements and there may not be enough health care providers to be able to take multiple measurements, leading to poor guideline adherence. Second, existing curricula do not provide adequate training for NPHW to take on an expanded role in CVD screening and management, resulting in minimal changes in clinical outcomes. Finally, whereas some curricula were meant to be incorporated across diverse settings, the generic, one-size fits all approach to training neglects the importance of cultural and contextual considerations that shape the delivery of health care in different settings around the world. After identifying these limitations, we revised existing BP treatment algorithms, empowered NPHW by utilizing the ABCD approach to community development, and made allowances in the curriculum to account for cultural and contextual differences related to how CVD and its risk factors are understood in different countries.

In phase 3, we considered the legal and ethical implications of a task-shifting curriculum in LMIC. Whereas similar initiatives have been supported by health care organizations around the world, regulatory frameworks often limit the roles and responsibilities that an NPHW can take on [20,21]. For example, most countries will not allow NPHW to prescribe or change the dose of medications, and these decisions need to be relayed to a physician. Therefore, consulting WHO's global recommendations and guidelines for task-shifting was a necessary step in defining the roles and responsibilities of NPHW [22]. The guidelines recommend that countries should assess and then consider using existing regulatory approaches where possible or undertake revisions to enable NPHW to practice with increased scope. Taking these recommendations into account, the HOPE-4 curriculum aimed to build on the evidence supporting greater responsibility for NPHW on the continuum of clinical autonomy.

During phase 4, we developed the curriculum modules along with the case scenarios and module tests. The modules were designed with an understanding that CVD prevention and management require a multifactorial approach and focus on addressing lifestyle factors such as diet, physical activity, smoking cessation, and alcohol misuse. The modules provide the latest evidence on lifestyle factors contributing to CVD and detail-specific strategies such as risk stratification, motivational interviewing, and goal-setting as tools for NPHW to incorporate into their counseling approach. Throughout this phase, we also emphasized the need to create an interactive and engaging curriculum where NPHW could participate in role-playing scenarios to enhance their required skills, lead discussions,

## Elements of HEARTS



### H HEALTHY LIFESTYLE

Counselling on tobacco cessation, diet, physical activity, alcohol use and self-care



### E EVIDENCE-BASED TREATMENT PROTOCOLS

Simple, standardized algorithms for clinical care



### A ACCESS TO ESSENTIAL MEDICINES AND TECHNOLOGY

Access to core set of affordable medicines and basic technology



### R RISK-BASED MANAGEMENT

Total cardiovascular risk assessment, treatment and referral



### T TEAM CARE AND TASK-SHARING

Decentralized, community-based and patient-centred care



### S SYSTEMS FOR MONITORING

Patient data collection and programme evaluation

**FIGURE 2. Elements of the World Health Organization Global HEARTS Initiative.** Reproduced with permission from World Health Organization [16].

and share their unique perspectives on health care. [Table 1](#) outlines the 8 content modules of the curriculum, beginning with an introduction to health and disease.

During phase 5 of curriculum development, we incorporated an objective structured clinical examination (OSCE), the preferred method of evaluation in clinical exams [23], allowing NPHW to gain valuable practical experience before going into the field. The topics of the OSCE scenarios are listed in [Online Appendix 1](#). To evaluate NPHW performance, we used a standardized 7-point Likert scale, with 1 being poor and 7 being excellent, and a minimum score of 5 being required in each OSCE scenario to successfully complete the training curriculum.

### Pilot Testing

The HOPE-4 training curriculum was piloted at our clinical research facility in Hamilton, Ontario, Canada, over the course of 5 sessions, each 3.5 h long. A cardiovascular nurse with >15 years of experience led the pilot sessions, and the curriculum was delivered in its entirety to 3 local high school graduates with minimal exposure to life sciences or

TABLE 1. HOPE-4 module descriptions

Number	Module	Description	Objective(s)
1	Health and Disease	Defining the terms health, disease, and risk factors	Understand key definitions
2	Organization and Communication Skills	Outlining necessary organization and communication skill required of NPHW	Become aware of the required skill set of an NPHW
3	The Cardiovascular System	Introduction to the cardiovascular system, components/functions, and diseases that affect it	Have a basic understanding of how the cardiovascular system functions
4	Risk Factors for Cardiovascular Disease	Risk factors contributing to CVD	To understand that substance abuse, poor diet, and lack of physical activity are risk factors for CVD Understand how hypertension, diabetes, high cholesterol, and blood pressure can also be risk factors
5	Cardiovascular Risk Assessment	Quantifying CVD risk factors	To understand how to use the WHO/PEN risk assessment charts To understand how to assess overall CVD risk
6	Cardiovascular Risk Prevention and Treatment	Counseling techniques for lifestyle and disease-related risk modification	To learn the various counseling techniques used in CVD prevention, treatment, and management
7	Pharmacological Management of Cardiovascular Disease	Aspects of pharmacology such as indications, contraindications, side effects, and mechanisms of action	Have a basic understanding of how different drugs can be used to manage CVD
8	HOPE-4 Program Specific Training	Administrative and logistical issues related to the HOPE-4 program	To understand the role of an NPHW in the HOPE-4 program
9	Observed Standardized Clinical Evaluation	Final evaluation of NPWH	Successfully pass all OSCE scenarios

CVD, cardiovascular disease; HOPE-4, Heart Outcomes Prevention and Evaluation Program; NPHW, nonphysician health care worker; OSCE, objective structure clinical examinations; PEN, Package of Essential Noncommunicable; WHO, World Health Organization.

cardiovascular care. They served as our pilot NPHW. The objective of the pilot sessions was to evaluate NPHW on the OSCE and determine any areas of confusion, inconsistency, and misinterpretation of the information being taught in the training curriculum. A team of evaluators consisting of 3 curriculum developers and the instructor scored the OSCE scenarios. We evaluated the NPHW's ability to appropriately communicate with the participant, apply the skills learned to a specific clinical situation, and demonstrate their problem-solving skills in a simulated environment.

### Implementation in Malaysia, Colombia, and Canada

The curriculum implementation process began in January 2014 in Malaysia, September 2014 in Colombia, and April 2015 in Canada. To initiate the training, Population Health Research Institute facilitated start-up meetings and outlined the objectives and timelines for completing the program and also served as the global coordinating center, and site coordinators in each setting were responsible for recruiting trainers, NPHW, and organizing the delivery of the curriculum. The sites in Colombia and Malaysia were both urban and rural whereas the inner city and suburban communities were chosen in Hamilton, Ontario, and Surrey, British Columbia, Canada. Although, the 8-module curriculum could be delivered over the course of a week,

the decision to administer the curriculum all at once or over the course of a few weeks was left up to the individual sites. Site coordinators were instructed to recruit volunteers, students, and nurses as NPHW, but the process of recruitment was also entirely up to the partnering organizations. Our partner institutions were Universiti Teknologi Majlis Amanah Rakyat in Kuala Lumpur, Malaysia; Clinica Fundación Oftalmológica de Santander in Bucaramanga, Colombia; the Hamilton Urban Core Community Health Centre in Hamilton, Ontario, Canada; and Surrey Firefighters Association in Surrey, British Columbia, Canada. The target population is individuals ( $\geq 50$  yrs) with  $\geq 1$  of the following criteria: 1) systolic blood pressure (SBP)  $\geq 160$  mm Hg in 1 visit; 2) SBP 140 to 159 mm Hg in 1 visit and participant-reported medical diagnosis of hypertension; 3) SBP 140 to 159 mm Hg in 1 visit and participant taking antihypertension medication; 4) SBP  $\geq 130$  mm Hg in 1 visit and participant-reported medical diagnosis of diabetes; 5) SBP  $\geq 130$  mm Hg in 1 visit and participant taking diabetes medication; and 6) participants that do not meet criteria 1 to 5 and SBP 140 to 159 mm Hg in 1 visit and SBP  $\geq 140$  mm Hg in a second visit  $\geq 24$  h apart.

NPHW in Colombia and Malaysia were recruited and trained over the course of 4 months in 2014. In Canada, NPHW were trained in 2 different settings. In Surrey, local firefighters were trained as NPHW as part of a community-

wide effort to train emergency personnel in basic chronic disease assessment and management. The Surrey Firefighters association was responsible for recruiting members, and the head of a local unit served as the curriculum trainer. Firefighters were chosen in Surrey as an opportunity to collaborate and build NPHW training into existing infrastructures established in Surrey. The firefighters were already going door-to-door as part of a “home safe” program to inspect fire alarms in high-risk areas. In Hamilton, a community health clinic helped facilitate the training of local health care workers who served as our NPHW.

The module tests, OSCE scenarios, and questionnaires were administered to assess curriculum uptake, compare performance across different settings, and gather qualitative feedback about the training process. To standardize the training process, module tests were always administered after NPHW completed each lecture, providing an opportunity to reinforce curriculum content before moving on to the next topic. The module tests consisted of a series of true/false questions to be completed after each module. These questions are designed to assess key objectives and knowledge of curriculum content. For example, after completing the “Risk Factors for Cardiovascular Disease” module, NPHW were asked whether smoking is a risk factor for hypertension or whether a BP reading above 140/90 is a diagnosis of hypertension.

The feedback questionnaire gathered background data about NPHW such as demographics, previous training as a health care worker, and assessed NPHW satisfaction with the training process. The OSCE was administered as a final evaluation to assess NPHW decision making in a clinical setting, and the results from the OSCE are presented to compare performance across different settings.

### Statistical Considerations

Continuous variables are presented as mean  $\pm$  SD. Categorical variables are presented as counts and percentages and 95% confidence intervals (CIs) when appropriate.

## RESULTS

### Pilot-Testing Results

Three NPHW (local high school students) successfully completed the OSCE, scoring 84%, 90%, and 87%, respectively, across the 13 scenarios.

### Implementation Results

The curriculum was administered in its entirety in Malaysia, Colombia, and Canada. To date, 51 NPHW have completed the training curriculum. Thirty NPHW were trained in Malaysia, 13 in Colombia, and 8 in Canada. Module test scores are available for 42 NPHW, and OSCE scores are available for 39 NPHW.

Baseline characteristics were available for all 51 NPHW and are presented in Table 2. In this group, women composed 61% of the overall training cohort, and 43% of the NPHW had prior experience in health care. Overall, 26% of the NPHW trained had prior experience in CVD prevention. A higher proportion of women (85%) were trained in Colombia as opposed to Malaysia (60%) and Canada (25%). NPHW in Colombia were nursing assistants, whereas NPHW trained in Malaysia included nurses, medical assistants, and research assistants. In comparison, NPHW in Canada included firefighters and community health workers. In Colombia, 85% of the NPHW trained had prior experience in health care whereas 33% of the NPHW in Malaysia and 13% in Canada had prior health care experience. Lastly, 33% of the NPHW in Malaysia had previous experience in CVD prevention compared with Colombia and Canada, where 15% and 13% of the NPHW had experience in CVD prevention, respectively.

Mean  $\pm$  SD module test scores in Malaysia, Colombia, and Canada were  $92.52 \pm 2.75\%$  (95% CI: 91.27 to 93.77),  $92.46 \pm 2.97\%$  (95% CI: 90.67 to 94.25), and  $96.15 \pm 2.02\%$  (95% CI: 94.8 to 97.6), respectively, and are displayed in Figure 3. Overall, NPHW scored a mean of  $93.19 \pm 2.67\%$  (95% CI: 92.36 to 94.02) on the module tests. Mean  $\pm$  SD OSCE scores in Malaysia, Colombia, and Canada were  $87.30 \pm 4.49\%$  (95% CI: 85.07 to 89.53),  $79.12 \pm 17.53\%$  (95% CI: 68.53 to 89.71),  $87.8 \pm 10.8\%$  (95% CI: 80.3 to 95.3), respectively, and are displayed in

TABLE 2. NPHW characteristics

	Malaysia (n = 30)	Colombia (n = 13)	Canada (n = 8)	Overall (n = 51)
Women, %	60	85	25	61
Type of NPHW (number trained)	Nurses (16) Medical assistants (3) Research assistants (11)	Nursing assistants (13)	Community health workers (4) Firefighters (4)	
Prior experience in health care, %	33	85	13	43
Prior experience in CVD prevention, %	33	15	13	26

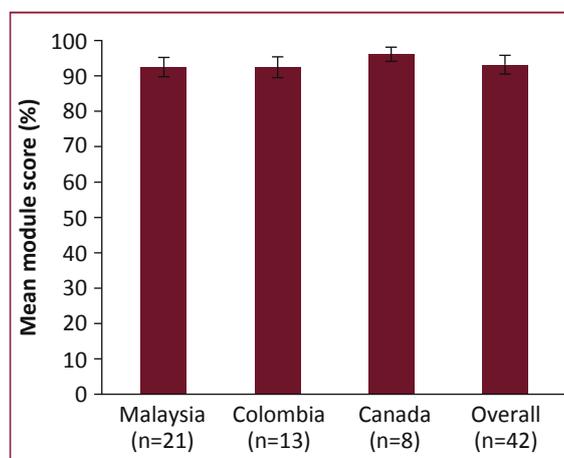
Abbreviations as in Table 1.

**Figure 4.** Overall, NPHW scored a mean of  $84.76 \pm 10.13$  (95% CI: 81.48 to 88.04) on the OSCE.

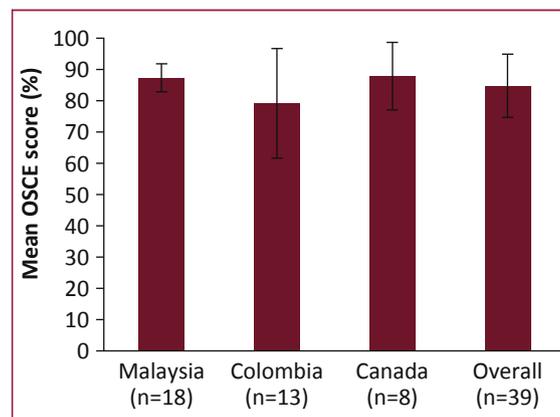
After completing the training curriculum, an NPHW feedback form was administered to gather qualitative data on the training experience. Twenty-six NPHW completed the form and the results are displayed in **Figure 5**. Whereas 61.4% of the NPHW were comfortable in their prior understanding of the CV system, only 26.9% said they had prior understanding of counseling and treatment methods in CVD management. With respect to organization and delivery of the curriculum, 96.1% agreed that the curriculum was well organized, 92.3% agreed there was good balance of lecture and group activities, and 84.6% agreed that the content was easy to understand and that the module tests were helpful. Finally, 73.2% of the NPHW agreed that the curriculum could be adapted to other settings while 92.3% agreed that they felt well trained to perform tasks such as measuring BP, taking a history, and measuring the waist-hip ratio.

## DISCUSSION

This paper described the process of developing, pilot-testing, and implementing an NPHW training curriculum aimed at lowering the global burden of CVD. Utilizing the ABCD model of community development, we aimed to empower NPHW by providing a greater level of responsibility in the screening, detection, and management of CVD. Throughout the development process, we made a concerted effort to reflect on the responsibilities of NPHW and designed the curriculum with the goal of providing them with ample opportunities to feel comfortable in their role. We believed we accomplished this goal, as NPHW in a diverse range of settings, felt equipped to perform critical tasks such as screening participants based on BP measurements, measuring waist-hip ratios, and counseling participants. The strength of this training curriculum lies in its ability to be adapted in both LMIC and low-resource settings in HIC, which is



**FIGURE 3.** Mean module test scores. Bar =  $\pm 1$  SD.



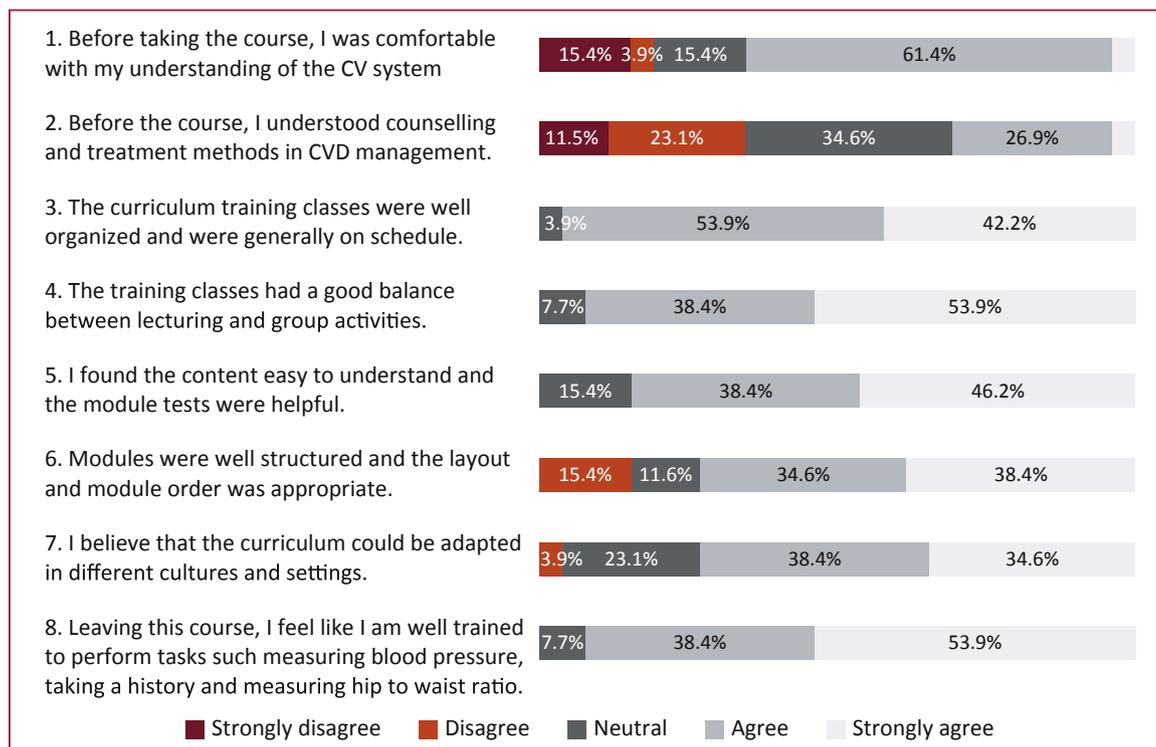
**FIGURE 4.** Mean objective structured clinical examinations (OSCE) scores. Bar =  $\pm 1$  SD.

supported by the feedback questionnaire data and similar performance across the different settings on the module tests and the OSCE.

By combining elements of a phased approach to curriculum development, task-shifting to NPHW and administration of standardized assessments, the HOPE-4 program highlights a novel approach to public health interventions. The current reports on task-shifting are mostly limited to training health workers in communicable diseases, and in instances where NCD are targeted, the actual training process is rarely documented. Our description of the phased curriculum development process along with the implementation experience is unique because it offers a comprehensive account of the entire training process.

Task-shifting has been demonstrated to be a low-cost, safe, effective, and evidence-based approach to tackling the global health worker shortfall [24]. In our experience, a systematic approach to training and assessing NPHW in LMICs is a potential solution to this large-scale problem. Whereas the implementation process presented unique challenges in the different settings, our experience serves as a positive example of how task-shifting initiatives can address the global burden of other NCD as well. Unfortunately, the NPHW were not able to prescribe or renew the HOPE-4 study medications due to regulatory limitations in the participating countries. Although the NPHW made treatment recommendations based on CV risk and potential contraindications, the study physician made the ultimate decision regarding medication initiation and continuation. Hopefully the HOPE-4 study combined with existing evidence can help influence regulatory agencies to allow NPHW to initiate medications in low-treatment-risk populations under physician supervision [10–14].

The major limitations of our study include the small number of NPHW trained, lack of control over the training schedules in Colombia and Malaysia, and missing data. Module tests were unavailable for 9 NPHW and 12 NPHW did not complete the final OSCE. Reasons for missing data include NPHW lost to follow-up and failure to submit



**FIGURE 5. Nonphysician health care worker (NPHW) feedback questionnaire results (n = 26).** CV, cardiovascular; CVD, cardiovascular disease.

scores to the coordinating center. The missing data may result in a potential bias toward more skilled respondents being included in our results. Even though we have trained an appropriate number of NPHW for the purposes of screening participants for the HOPE-4 program, the small numbers limit our ability to fully interpret the findings. At this stage we have developed, pilot-tested, and implemented the HOPE-4 NPHW training curriculum in 3 countries, demonstrating adequate uptake of the curriculum content. Ongoing evaluation of the HOPE-4 study will help inform the impact of this training curriculum. Furthermore, adaptation of this curriculum to the WHO HEARTS program, coupled with plans for evaluation, will provide more robust data to support its dissemination and implementation at scale. Overall, we have gathered and presented encouraging qualitative and quantitative data to support our finding that this model of training NPHW is effective and adaptable to many different settings.

### Global Significance

The HEARTS technical package, which has been developed in response to the global action plan, provides a comprehensive set of evidence-based, practical, and effective interventions to improve the management of risk factors for CVD in primary health care. A summary of the different components of HEARTS is provided and outlined in [Figure 2](#). The HOPE-4 curriculum has been adapted into a

training manual for primary health workers (PHWs) as part of the team care and task-sharing element of HEARTS. The training manual will be provided as a template for adaptation of country manuals to train PHW at the primary health care level in integrated management of CV risk factors including hypertension, diabetes, high cholesterol, and behavioral risk factors.

Adaptation of the curriculum to the WHO's Global HEARTS initiative highlights the importance of a task-shifting approach to target CVD control. Whereas the HOPE-4 program has demonstrated that this approach can be effective and adaptable to many settings, the Global HEARTS initiative will build on this evidence base starting with a pilot process of the curriculum in 8 LMIC. The piloting process is a chance to refine the curriculum, obtain more robust input in real-world settings, and scale-up the training ethos more widely. The training will also be in concert with other key elements such as standardization of treatment algorithms, core medication lists, and CVD monitoring systems. Lastly, while the curriculum will be implemented in different settings, all PHW are expected to undergo the training at primary health facilities under the supervision of physicians as well as participate in ongoing updates, evaluations, and refresher seminars. The results from this wide-scale piloting and implementation process will allow participating countries to incorporate the HEARTS Technical Package as a tool to achieve the targets set out in the global action plan.

## CONCLUSIONS

Through the curriculum design and implementation process, we have demonstrated that NPHW can be trained and evaluated in CVD prevention and control. The HOPE-4 training curriculum presents a unique opportunity to invest in local resources by training NPHW to undertake CVD screening, detection, and management in LMIC and lower-resource settings within HIC. Through the 5 phases of development, a comprehensive training curriculum was successfully developed, piloted, and implemented in Colombia, Malaysia, and Canada. The similar performance on module tests and OSCE assessments indicates that this training curriculum can be implemented in diverse settings with limited variability in terms of knowledge, clinical skills, and satisfaction with the training process. As CVD continues to rise disproportionately in LMIC, our development, testing, and implementation process, as well as the recent adaptation to the WHO's Global HEARTS initiative, can be used as a model for future initiatives aimed at lowering the burden of other NCD.

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## **ONLINE APPENDIX 1. OBJECTIVE STRUCTURED CLINICAL EXAMINATION (OSCE) SCENARIOS**

### Section 1. Taking a medical history

- Scenario 1. Alcohol abuse and smoking
- Scenario 2. Cardiac history
- Scenario 3. Diet and exercise

### Section 2. Physical exam

- Scenario 4. Measuring blood pressure
- Scenario 5. Measuring waist-hip ratio
- Scenario 6. Risk stratification

### Section 3. Lifestyle Modification Counseling

- Scenario 7. Diet and exercise
- Scenario 8. Smoking cessation

### Section 4. Medication adherence and side effects monitoring

- Scenario 9. Assessment of medication adherence
- Scenario 10. Medication adherence counseling
- Scenario 11. Monitoring signs and symptoms

### Section 5. Participant recruitment process

- Scenario 12. Participant refuses consent
- Scenario 13. Dealing with a frustrated participant