Dissemination and Implementation Program in Hypertension in Rwanda

Report on Initial Training and Evaluation

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ABSTRACT

Background: Cardiovascular disease (CVD) is the leading cause of morbidity and mortality worldwide and in low- and middle-income countries, and hypertension (HTN) is a major risk factor for CVD. Although effective evidence-based interventions for control of HTN in high-income countries exist, implementation of these in low- and middle-income countries has been challenging due to limited capacity and infrastructure for late-phase translational research. In Rwanda, the 2015 STEPS NCD (STEPwise Approach to Surveillance of Noncommunicable Diseases) risk survey reported an overall prevalence of HTN of 15% (95% confidence interval [CI]: 13.8 to 16.3) for those ages 15 to 64 years; prevalence increased with increasing age to 39% (95% CI: 35.7 to 43.1) for those ages 55 to 64 years; CVD was the third most common cause of mortality (7%). Suboptimal infrastructure and capacity in Rwanda hinders research and community knowledge for HTN control.

Objectives: To address the issue of suboptimal capacity to implement evidence-based interventions in HTN, this project was designed with the following objectives: 1) to develop a regional needs assessment of infrastructure for dissemination and implementation (D & I) strategies for HTN-CVD control; 2) to develop HTN-CVD research capacity through creation of countrywide resources such as core research facilities and training in the fields of HTN-CVD, D & I, and biostatistics; and 3) to engage and train multiple stakeholders in D & I and HTN-CVD evidence-based interventions.

Methods: A weeklong training program in HTN-CVD, biostatistics, and D & I was conducted in Rwanda in August 2018, and pre- and post-D & I training competency questionnaires were administered.

Results: Questionnaire results show a statistically significant increase in D & I knowledge and skills as a result of training (full scale pre- to post-test scores: 2.12 ± 0.78 vs. 3.94 ± 0.42; $p < 0.0001$).

Conclusions: Using principles of community engagement and train-the-trainer methods, we will continue to adapt guidelines and treatments for HTN-CVD developed in high-income countries to the context of Rwanda with the goal of establishing a sustainable platform to address the burden of disease from HTN-CVD.

Cardiovascular disease (CVD) is the leading cause of morbidity and mortality worldwide. The World Health Organization estimates that CVD deaths are 3-fold higher in low- and middle-income countries (LMIC) versus high-income countries (HIC) [1,2]. In LMIC, CVD is responsible for more deaths than human immunodeficiency virus, malaria, and tuberculosis combined [3,4]. As opposed to HIC where CVD deaths occur mostly in people ≥60 years, CVD deaths in LMIC occur largely in younger, working-age people [1]. This creates a double jeopardy in terms of health care and economic burden: an increasing number of young people are affected with CVD at a time when they should be in their most productive years of life [3]. Almost 7.8 million premature CVD deaths will occur in 2025, mostly in LMIC, if current global CVD risk factor trends continue, outpacing the number of deaths in HIC [5].

Rwanda is a sub-Saharan LIC with a population of 10.5 million people (51.8% female); the population is relatively young (those <34 years of age represent 77.5% of the population) and there is high population density (415 people per square kilometer, with 16.5% living in urban areas) according to the August 2012 census [6]. Limited epidemiological data in Rwanda, based on World Health Organization estimates, suggest markedly high

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prevalence of both hypertension (HTN) and CVD, with approximately 36% of deaths caused by noncommunicable diseases (NCD), of which CVD ranks third at 7% [7,8]. The 2015 Rwanda NCD risk survey based on the World Health Organization STEPS (STEPwise Approach to Surveillance) NCD reported an overall HTN prevalence of 15.0% (95% confidence interval [CI]:13.8 to 16.3) for those ages 15 to 64 years and 39.3% (95% CI: 35.7 to 43.1) for those ages 55-64 years. Factors associated with HTN included male sex, older age, low physical activity level, alcohol consumption, tobacco smoking, and obesity. These data from Rwanda are consistent with those of other sub-Saharan countries such as Malawi and Tanzania, where a regional cross-sectional study showed prevalence of HTN and pre-HTN in adults of 22% and 44%, respectively, reflecting the significance of HTN in LMIC [9].

Dissemination and implementation (D & I) science, with its multilevel frameworks, outcomes, and designs, is geared toward increasing uptake and sustainment of evidence-based interventions (EBIs) for prevention, treatment, and control of hypertension [10-12]. Suboptimal infrastructure and capacity in Rwanda hinders research and community knowledge for HTN control. Our U24 grant project funded by the National Heart, Lung, and Blood Institute (NHLBI) aims to develop late phase (T4) translational research capacity for control of hypertension in Rwanda through D & I research capacity building.

To address the issue of suboptimal capacity to implement EBI for HTN, our team designed a project with the following objectives: 1) to develop a regional needs assessment of infrastructure for D & I strategies for HTN-CVD control; 2) to develop HTN-CVD research capacity through creation of countrywide resources such as core research facilities and training in the fields of HTN-CVD, D & I, and biostatistics; and 3) to engage and train multiple stakeholders in D & I and HTN-CVD EBI.

This paper reports on our initial efforts toward achieving the NHLBI U24 grant objectives. These efforts included a pre- and post-D & I training questionnaire to assess competency and a weeklong training program in HTN-CVD, biostatistics, and D & I conducted in Rwanda. The training program was well received and the post-training questionnaire showed statistically significant increase in D & I knowledge and skills as a result of training.

METHODS

Training program in HTN-CVD, D & I, and biostatistics. Over the course of 5 months, a weeklong program, taking into consideration Rwandan trainee needs and the training objectives of the U24 grant was developed by a team composed of coinvestigators from Washington University, the Rwanda team (RASD), and NHLBI U24 leadership. The program was advertised locally in Kigali, Rwanda and potential participants were asked to sign up. Participants were informed and consented to participate in the D & I survey and training, and self-reported demographic data was obtained from each participant. The training included lectures on research career development, HTN-CVD, biostatistics, and D & I. The Washington University team also visited and met with stakeholders at the University of Rwanda, major teaching hospitals, and community health care facilities to foster clear bidirectional partnerships and to ensure that the work is done in consultation and in coordination with the Rwanda team and stakeholders, as previously described [13]. Furthermore, D & I trainers used training examples drawn from the HTN-CVD focused visits and stakeholder discussions to enhance the didactic D & I lectures using practical and Rwandan-specific examples.

HTN-CVD training

The HTN-CVD training sessions were used as a framework for the D & I training. Lectures from HTN-CVD experts covered the global impact of CVD-HTN and HTN guidelines. A representative from the Rwanda Ministry of Health discussed the current state of CVD-HTN knowledge and guidelines in the country. As stated previously, this information was used to inform and complement the D & I training modules.

Needs assessment for the training

Trainee capacity for D & I research was assessed using validated competencies [14,15]. Trainees completed the D & I competency assessment prior to the first day of training (pre-test), and at the conclusion of the D & I training session (post-test). Using a 5-level Likert scale (1 = not at all to 5 = extremely), the questionnaire assesses competencies across 4 domains: 1) D & I research skills; 2) theories and research approaches; 3) study designs and analysis; and 4) practice-based considerations. D & I research methods, designs, theories, and frameworks are largely agnostic to the health intervention and/or health condition and as such the competencies assessment were focused on general D & I principles and methods.

In addition, 2 subscales developed by Cook et al. [16] to assess factors related to practice variation and the use of clinical guidelines were also administered. These subscales included the barrier subscale, which asks respondents to rate the degree of impact a particular barrier has on consistent, guideline-based care, and the facilitator subscale, which provides respondents with a list of actions that could help facilitate consistent, guideline-based care and asks them to rate how helpful those actions would be. Respondents rank the impact of these 2 subscales using a 4-level Likert scale (1 = not at all to 4 = very). All questionnaires were approved by the Washington University Institutional Review Board.

D & I training

The D & I training included 5 sessions of 3- to 4-h duration over 5 days. The didactic sessions covered topics such as D & I science key terms and definitions, conceptual frameworks and theories, identifying barriers

TABLE 1. Trainee education and current work (n = 24)

Trainee Positions	
Physician	25
Nurse practitioner	8
Administrator	8
Other*	59
Area of Work Within Health Care	
Research	58
HIV	33
Noncommunicable diseases	25
Community health	21
Work Setting	
University or academic	44
Government or NGO	26
University hospital	17
Community hospital	13

Values are %. *See text for a description of "Other."
HIV, human immunodeficiency virus; NGO, nongovernmental organization.

and facilitators to uptake of EBI, stakeholders in practice improvement, implementation outcomes and their measurement, implementation strategies, and research designs for D & I with particular focus on HTN-CVD. The didactic sessions were complemented by small group discussions with application activities led by experts in HTN-CVD topics. The small group discussions focused on the identification of multilevel barriers to evidence-based HTN-CVD care, facilitators to EBI uptake, and strategies that had proven successful in prior EBI implementation in Rwanda (e.g., for human immunodeficiency virus/acquired immunodeficiency syndrome care) and that therefore hold promise for implementing HTN-CVD EBI. This mix of didactic and small group—application sessions was based on our previous experience building D & I research capacity [17]. At the end of each session, participants were asked to identify insights gained from the session and topics that remained unclear. These frequent feedback exercises served as a process to involve key stakeholders from Rwanda in the development of the curriculum and their input informed the material that was presented in subsequent sessions.

Data analysis

The change in D & I competencies was assessed by paired Student's *t*-test that used the average score of each subscale of the D & I competency questionnaire. There were 24 trainees who completed the pre-test and 20 who completed the post-test; only results from respondents who completed both surveys are reported. Results from the Cook subscales were analyzed using descriptive statistics. All data management and statistical analyses were performed using Stata version 14.2 (Stata Corp., College Station, TX).

RESULTS

A total of 24 health care—related professionals participated in the training (referred to as trainees). Professional characteristics of the trainees are shown on Table 1. Trainee positions within the health care system included physicians (25%), nurse practitioners (8%), and administrators (8%); 59% held "other" positions including health care researchers, biostatisticians, public health professionals (i.e., masters of public health), and health care policy, oral health (i.e., dentists), and diet and nutrition specialists.

Within the health care area, the majority were involved in research (58%), human immunodeficiency virus (33%), NCD (25%), and/or community health (21%). The majority of trainees had 10 years or less of experience (75%), with the remainder of the group reporting between 11 and 20 years of experience (25%); none reported >20 years of experience. Most of the trainees reported working at a university and/or other academic and/or teaching institution (44%), at government or nongovernmental organizations (26%), and at university teaching hospital (17%) or district community hospital (13%).

The results of the pre- and post-test training competency scores are shown in Table 2. To determine whether there was an association between respondents' data and whether the respondents had any missing items, chi-square tests were performed. There were no statistically significant differences, in terms of respondent's characteristics between those respondents with complete or incomplete surveys. D & I competency increased significantly (pre- to post-test: 2.12 ± 0.78 vs. 3.94 ± 0.42; $p < 0.0001$). On the pre-test survey, trainees rated themselves as slightly competent in D & I, and at the post-test evaluation, their rating almost doubled, to moderately competent. Trainees

TABLE 2. D & I competencies, pre- to post-test change in scores

	Pre-Test	Post-Test	p Value
Definitions, background, and rationale	2.54 ± 0.94	4.15 ± 0.46	0.0002
Theory and approaches	2.00 ± 0.78	3.95 ± 0.49	<0.0001
Design and analysis	2.00 ± 0.78	3.74 ± 0.15	<0.0001
Practice-based considerations	2.01 ± 0.82	3.97 ± 0.44	<0.0001
Full scale	2.12 ± 0.78	3.94 ± 0.42	<0.0001

D & I, dissemination and implementation.
Scale: 1 = not at all to 5 = extremely.

TABLE 3. Most impactful barriers and most helpful actions to provide consistent, guideline-based care

Barriers	Mean ± SD
Lack of awareness of existing evidence and guidelines	3.47 ± 0.70
Differences in practice context and patient population	3.39 ± 0.70
Differences in clinician experience and training	3.32 ± 0.67
Individual patient preferences	2.94 ± 0.87
Lack of access to needed evidence and guidelines	2.89 ± 0.74
Difference in clinician style and preferences	2.89 ± 0.88
Helpful Actions	
Better access to guidelines and synthesized evidence	3.74 ± 0.45
More time to look up, appraise, and apply available practice standards	3.63 ± 0.50
More frequent feedback on how one's practice compares with others	3.47 ± 0.77
Decision aids to help with patient counseling	3.42 ± 0.69
Clearly stated institution-wide standard practices	3.37 ± 0.76
Having someone else order common/straightforward tests	3.35 ± 0.61
Standardized order sets	3.26 ± 0.87

Scale: 1 = not at all to 4 = very.

significantly improved on the "Definitions, Background, and Rationale" subscale (pre- to post-test: 2.54 ± 0.94 vs. 4.15 ± 0.46; $p = 0.0002$); on the "Theories and Approaches" subscale (pre- to post-test: 2.00 ± 0.78 vs. 3.95 ± 0.49; $p < 0.0001$); the "Design and Analysis" subscale (pre- to post-test: 2.00 ± 0.78 vs. 3.74 ± 0.15; $p < 0.0001$); and the "Practice-Based Considerations" subscale (pre- to post-test: 2.01 ± 0.82 vs. 3.97 ± 0.44; $p < 0.0001$). So that we could better understand available resources, trainees were asked whether they had access to mentoring to meet their professional development needs. Over one-half of trainees (52%) reported that they did not have access to a D & I mentor. Trainees were asked to state the most important roles expected of a D & I mentor. The most frequently endorsed roles by respondents were "train me in specific areas of D & I research" (n = 11, 42%), "teach by example" (n = 8, 30%), and "provide career advancement guidance" (n = 7, 29%).

Results from the Cook subscales are shown in Table 3. The 3 barriers with the highest group means were "lack of awareness of existing evidence and guidelines" (group mean: 3.47 ± 0.70), "differences in practice context and patient population" (group mean: 3.39 ± 0.70), and "differences in clinical experience and training" (group mean: 3.32 ± 0.67). Trainees rated the following actions as the 3 most helpful to improve the standardization of care between clinicians "better access to guidelines and synthesized evidence" (group mean: 3.74 ± 0.45), "more time to look up, appraise, and apply available practice standards" (group mean: 3.63 ± 0.50), and "more frequent feedback on how one's practice compares with others" (group mean: 3.47 ± 0.77).

DISCUSSION

Brief discussion of the competencies evaluation

As per our NHLBI U24 project objectives, we implemented as a first step a weeklong D & I, HTN-CVD, and biostatistics training course and performed evaluation of D & I competencies in concert with our Rwandan partners and stakeholders. The results of the D & I competencies survey show the following major findings. First, the trainee group comprised relatively junior to mid-level health care providers, researchers, and administrators. Second, the majority are involved in direct patient care, health care training and/or education, and/or health care research (e.g., statistics, policy). Third, their D & I competencies improved significantly as a result of the weeklong training. Fourth, trainees developed implementation strategies aimed at enhancing the uptake of EBI in HTN-CVD. Finally, trainees identified key barriers to HTN-CVD control that will inform and facilitate subsequent planning, training and implementation strategies.

Epidemiology of hypertension in LMIC

Hypertension is the most common disease in the world and the most prevalent risk factor for CVD [1-5,18,19]. The prevalence of HTN in LMIC ranges from 32% to 78%; among individuals ≥50 years of age, an overall prevalence of 53% has been reported [20-23]. HTN accounts for 10.5 million deaths and 12.8% of total global disability-adjusted life years. HTN leads to adverse changes in the structure and function of the heart, including left ventricular hypertrophy, myocardial infarction, atrial fibrillation, and congestive heart failure [24,25]. HTN is the most common risk factor for stroke, peripheral arterial disease, and end-stage renal disease [26-29]. As such, HTN plays a major central role in the development of devastating complications and represents an important contributor to the global burden of CVD.

Barriers for control of HTN and CVD in LMIC

It takes about 17 years for EBI findings to be adopted in usual clinical care at the population level [30]. Barriers to implementation of EBI for HTN control have been found at all health care levels, including systems, providers, and patients [31]. Some of these barriers include the following: 1) lack of awareness of importance of global CVD; 2) lack of balance of competing priorities when allocating resources; 3) concerns that non-CVD–related health priorities will be adversely affected by diverting resources to CVD; 4) insufficient health systems to support CVD control; 5) conflicting obligations of private sector versus public health goals; 6) uncertainty of effectiveness, feasibility, and lack of D & I of health-related policies, programs, and services; 7) fragmentation, inadequate coordination, insufficient accountability, and unclear leadership of CVD-related health stakeholders; 8) inadequate support from international organizations and/or donors [32,33]. All these barriers specific to HTN-CVD care in

TABLE 4. Challenges, barriers, facilitators, and solutions

Challenges for Stakeholder Engagement	Structural Barriers
Early stage trainees with limited research experience and limited knowledge of D & I science	Limited local mentors in D & I, research methods, and biostatistics
Limited stakeholder engagement, particularly those at higher levels of government (i.e., Ministry of Health)	Limited awareness and/or access to EBI in hypertension
Language barriers limits in-depth communication, particularly with local health care providers, community health workers, and community members	Differences in health care practice context at the local, regional, and district levels
Limited NCD knowledge and experience at multiple levels in health care system	Differences in patient characteristics and presentation to health care facilities
	Differences in health care provider training and clinical experience
	Competing resources and priorities between communicable diseases and NCD
Overcoming Challenges for Stakeholder Engagement	**Overcoming Structural Barriers With Facilitators**
Use of needs assessment tools to tailor training for D & I science capacity building	Multilevel provider training and education in D & I science and in EBI in hypertension
Provided in-person training in D & I science	Continue collaboration with Ministry of Education to improve training on EBI in hypertension at School of Medicine
Met with high-level university officials to discuss faculty training and career development opportunities	Engage Ministry of Health to produce updated, user-friendly and time-efficient hypertension evaluation and treatment guidelines
Met with tertiary care facility health care administrators and providers to facilitate bidirectional partnership development for capacity building	Organize Rwanda Chapter of the World Hypertension League
Engaged leaders at regional hospital to establish direct connections to local clinics and community health workers	Develop organized group for support and education for hypertension awareness and treatment
Identified leaders for core research facilities in D & I, biostatistics, cardiometabolic phenotyping, and career development	Develop core research facilities to encourage and facilitate research
Identified successful strategies previously applied in HIV/AIDS care to engage stakeholders at multiple levels in the care of patients with NCD	Develop hypertension home monitoring by use of community health workers

AIDS, acquired immunodeficiency syndrome; D & I, dissemination and implementation; EBI, evidence-based intervention; HIV, human immunodeficiency virus; NCD, noncommunicable disease.

LMIC were addressed during the weeklong training course in Rwanda. Trainees showed a high level of understanding of the unique challenges that result from competing demands in health care services, where both communicable diseases and NCD coexist in their low-resource setting [34,35]. Additionally, our Rwanda trainees showed a keen understanding that D & I research is well-suited to address these barriers and to formulate effective change.

Implementation strategies in HTN

Implementation strategies based on underlying theories or frameworks designed to improve the uptake of effective interventions to overcome barriers to HTN care have been tested [36-39]. In a recent meta-analysis for blood pressure control in HTN, multilevel, multicomponent strategies were found most effective for systolic blood pressure control [40]. At the provider level, effective implementation strategies include team-based care with medication titration by physicians and nonphysicians, and multilevel strategies without team-based care. At the patient level, health coaching and home monitoring were the most effective strategies. In terms of implementation strategies for LMIC, awareness campaigns, patient education and counseling on blood pressure monitoring, medication adherence, and lifestyle change promoted by community health workers, the use of mobile technologies to improve health care (i.e., mHealth), and engagement of the community are effective implementation strategies [41-43].

A major challenge to the implementation of EBI is to understand the cultural context so that the setting, strategies, or interventions can be effectively prepared and adapted to achieve the desired outcome [44-46]. Thus, engagement of multiple stakeholders and addressing structural barriers are key to developing an effective D & I-HTN-CVD—focused research platform specific to the Rwandan population as shown in Table 4. Using principles of community engagement and train-the-trainer methods, we will continue to adapt HTN-CVD, biostatistics, and D & I competencies developed in HIC to the context of

Rwanda with the goal of establishing a sustainable platform to address the burden of disease from HTN-CVD.

CONCLUSIONS

CVD and HTN are the most common causes of morbidity and mortality in LMIC such as Rwanda. Effective EBI for control of HTN in HIC exist, but implementation of these in LMIC has been challenging due to limited capacity and infrastructure for T4 translational research. This NHLBI U24 project was designed with the objective of developing a needs assessment to support the infrastructure for D & I of strategies for HTN-CVD control in Rwanda and to engage and train multiple stakeholders in D & I and HTN-CVD EBI. Accordingly, we report on initial efforts to achieve these objectives, as follows: 1) a weeklong training program in HTN-CVD, biostatistics, and D & I was performed in Rwanda; and2) pre- and post-D & I training competency questionnaires were administered. Questionnaire results showed statistically significant increases in D & I knowledge and skills as a result of training. Using principles of community engagement and train-the-trainer methods, we will continue to adapt guidelines and treatments for HTN-CVD developed in HIC to the context of Rwanda with the goal of establishing a sustainable platform to address the burden of disease from HTN-CVD.

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