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Exploring contextual factors influencing the implementation of evidence-based care for hypertension in Rwanda: A cross-sectional study using the COACH questionnaire

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Title: Exploring contextual factors influencing the implementation of evidence-based care for hypertension in Rwanda: A cross-sectional study using the COACH questionnaire

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Abstract

Importance: Hypertension is the largest contributor to the Global Burden of Disease. In Rwanda, as in most low- and middle-income countries, an increasing prevalence of hypertension and its associated morbidity and mortality is causing major health care and increasing economic impact. Understanding healthcare systems context in hypertension care is necessary to address these gaps.

Objective: To study the hypertension healthcare context as perceived by healthcare providers using the Context Assessment for Community Health (COACH) tool to assesses modifiable aspects of the healthcare context that influence implementation of evidence-base care.

Design: A cross-sectional cohort responded to the COACH questionnaire.

Setting: Three tertiary care hospitals in Rwanda.

Participants: Healthcare professionals (n=223).

Primary Outcome(s) and Measure(s): The COACH tool consists of 49 items with eight subscales: Resources, Community Engagement, Commitment to Work, Informal Payment, Leadership, Work Culture, Monitoring Services for Action (5-point Likert scale) and Sources of Knowledge (on a 0-1 scale).

Results: Responders (n=223, 75% women; 56% aged 20-35 years) included 64% nurses (64%), midwives, primary care physicians and specialists. The subscales Commitment to Work, Leadership, Work Culture and Informal Payment scored between 4.7 and 4.1, the Community Engagement, Monitoring Services for Action and Organizational Resources scored 3 -≤3.5. Sources of Knowledge had a mean score of 0.6±0.3. While most reported having attended a didactic hypertension seminar, only 28% had received long-term training, and 51% had <3 years experience working with hypertension care delivery. Most indicated a need for additional training in hypertension care.

Conclusions: There is a need for increased and continuous training in Rwanda. Healthcare responders stated a commitment to work and reported supportive leadership while acknowledging challenges with resources and systems to support improvement for quality of care. COACH tool provides contextual guidance for development of training strategies prior to implementation of a sustainable hypertension care program in Rwanda.

Key words: Hyperthension, Rwanda, contextual assessment, guidelines, education and training

Strengths and Liminations of the Study:

- A cross-sectional cohort of providers from three hospitals in Rwanda responded to the Context Assessment for Community Health (COACH) tool and a survey examining existing trainings in hypertension care.
- Respondents shared a high commitment to work and positive leadership, while indicating need for more training in hypertension care and monitoring.
- Based on the COACH tool training, strategies are being co-developed to implement a comprehensive and sustainable hypertension care program in Rwanda.

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Background

Hypertension, defined as high systolic blood pressure, is the most common disease in the world and the largest contributor to the Global Burden of Disease, affecting over 1.2 billion people worldwide. Hypertension is the most prevalent risk factor for the development of cardiovascular disease (CVD).[1] The overall global prevalence of hypertension exceeds 50% of adults older than 50 years, and in low- and middle-income countries (LMICs) ranges from 32%-78%. [2–4] Rwanda, located in sub-Saharan Africa, is a LMIC with 12.4 million relatively young people (those <34 years of age represent 78% of the population), and with a high population density. [5,6] Rwanda is undergoing an epidemiological transition with an increasing co-existence of infectious diseases and non-communicable diseases (NCDs) such as hypertension.[6,7] Epidemiologic data from Rwanda estimates a high prevalence of both hypertension and CVD, which together account for 36% of deaths.[8] The 2015 Rwanda NCDs risk survey based on the World Health Organization (WHO) STEPS framework (STEPwise Approach to Surveillance) reported an overall hypertension prevalence of 15% (95% confidence interval [CI]: 13.8 to 16.3) for those aged 15 to 64 years and 39% (95% CI: 35.7 to 43.1) for those aged 55–64 years, with deaths attributable to hypertension at 18/100,000.[9] These data are consistent with those of other sub-Saharan countries, reflecting the importance of hypertension as a public health burden in Sub-Saharan Africa.[10]

While evidence-based intervention (EBI) studies have shown that treatment and control of hypertension decreases morbidity and mortality, barriers for the implementation of these interventions have been found at all healthcare levels, including systems, providers, and patients.[11] The application of dissemination and implementation (D&I) science allows for a rigorous and systematic approach to develop implementation strategies and improve the uptake of effective EBIs for hypertension care.[12]

Selection of implementation strategies, that is, methods to implememt these EBI in usual care, should be based on frameworks and on an understanding of the context where the intervention will be implemented.[13] The Promoting Action on Research Implementation in Health Services (PARIHS) is a framework that outlines three core elements (evidence, context and facilitation) for successful EBI implementation. Context, defined as "the environment or setting in which the proposed change is to be implemented" is comprised of three sub-elements: culture, leadership and evaluation, dimensions being evaluated in this study.[14-15] The Context Assessment for Community Health (COACH), a validated theory-based tool aimed at examining healthcare contexts in LMICs, is a 49-item survey based on the context dimension of the PARIHS framework and the interconnected building blocks of the World Health Organization.[15] The COACH tool was developed to identify barriers for EBI implementation, to guide planning and adaptation of the strategies to increase the uptake of the EBIs, and to link contextual characteristics to outcome indicators of healthcare interventions.[15] Due to its theoretical base and its acceptable reliability and validity among providers in LMICs including Vietnam, Bangladesh, Uganda, South Africa, and Nicaragua[15,16], COACH was used in the present study to examine the context of hypertension care in three hospitals in Rwanda as reported by healthcare providers.

Methods

Study setting. The study was conducted at three hospitals (district or provincial) in Rwanda; to maintain the confidentiality of participants, the hospitals are identified as A, B and C. The study was approved by the University of Rwanda CMHS Institutional Review Board and by the Washington University School of Medicine Institutional Review Board Committee.

Participants. Participants were healthcare providers working in the included hospitals. Lists of all medical professional staff (nursing, midwife, physicians) were provided by the hospital

administrations to the study team; from these lists, study participants were contacted to participate in the study. All those who were contacted agreed to participate, all signed informed consent, and subsequently underwent in-person interviews to complete the survey.

Questions about provider training in hypertension. Health care providers were asked four questions regarding training in hypertension care: i) have you received didactic or school-based training on hypertension? (response options for first three questions: in the past year, before the past year, never); ii) have you received a structured long-term (>1 month course) training on hypertension?; iii) have you received on job training, in-service or supervision on the management of hypertension?; and iv) do you feel there is need for additional training in the management of hypertension? (response options: yes, no/not sure).

Questions about health care system context. The COACH tool consists of 49 questions across eight subscales. "Organizational Resources" refers to the availability of human capacity and materials that allow an organization to implement an intervention successfully. "Community Engagement" refers to mutual communication and activities that occur between community members and the organization. "Monitoring" refers to the process of using locally derived data to evaluate performance and plans to improve outcomes. "Sources of Knowledge" refers to the availability and use of sources of facts, information, and skills acquired by providers through experience or education in an organization that facilitate best practice. "Commitment to Work" refers to an individual identification with and involvement in an organization. "Work Culture" refers to the process of an organization, reflecting a shared set of values, ideas, concepts and rules of behavior that allow the organization to function. "Leadership" refers to the actions of a person in the organization who can influence change and excellence in practice, achieved through clarity and engagement. "Informal Payment" refers to bribe and/or benefits given to an individual outside

of the officially accepted arrangements.[15] Respondents were asked to rate their level of agreement using a five-point Likert scale for all items, except for items in the "Sources of Knowledge" subscale where the scale is from 0 to 1, regarding the use of the hypertension guidelines within a specified time frame and the availability of different sources of knowledge.

Translation and adaptation of COACH tool. The majority of healthcare workers in Rwanda do not routinely communicate in English. For this reason, the COACH tool was translated from English to Kinyarwanda (study participants' daily language), and subsequently back translated to English by two Rwandan bilingual experts in both English and Kinyarwanda to ensure the accuracy of the translation. Items that needed further clarification were discussed with the tool developer and agreement on the translation was reached by consensus. Additionally, we adapted the questions to be specific in relation to hypertension care (e.g., "This facility is willing to use new healthcare practices such as guidelines and recommendations for HTN").

Patient and Public Involvement: The COACH questionnaire has been previously validated in LMICs and was modified by the research team to address the context of hypertension in Rwanda through our weekly calls. The Rwandan co-investigators had primary responsibility for the translation (English to Kinyarwanda) and back-translation of the COACH questionnaire and for development, recruitment and conduction of the study. Patients were not involved in the development, recruitment or conduction of the study. The results of this study has been shared with stakeholders in Rwanda through our yearly meetings. Additional dissemination with the ministry of Health, academic institutions, health care providers and others will occur once the manuscript is published.

Data collection. Data were collected by in-person interviews, using structured questionnaires in paper and pencil format, and subsequently transferred in duplicate entry to Qualtrics by members

of the research team. There were no missing values for any of the questions and any discrepancies in data entry were resolved. The survey was administered between May 27 through June 4, 2019.

Analysis. Demographics are reported as the total number of respondents and percentage in each group. Differences among hospitals were assessed using chi-square tests or Fisher's exact tests as appropriate. COACH dimensions are reported as means ± standard deviation, for each hospital and combined across all hospitals. Cronbach's α, a coefficient of reliability, was used to determine internal consistency of the test items and the average inter-correlation between the items in each dimension. Scoring of sources of knowledge dimension ranged from 0 (not available, never/rarely), 0.5 (occasionally), to 1 (frequently/always); scoring for the other subscales ranged from 1 (strongly disagree) to 5 (strongly agree).[17] The first six items in the informal payment dimension were reverse-scored so that the directional interpretation was similar to the other dimensions.

A one-way analysis of variance (ANOVA) was used to test for differences in mean dimension scores among the three hospitals. All analyses were conducted using SAS, 9.4 (SAS Institute Inc., Cary, NC, USA) and *P*-values < 0.05 were considered significant.

Results

The total number of respondents (n=223) included nurses, midwives, primary care physicians and specialty physicians (Table 1); similar representation from all three hospitals was obtained across hospitals. The majority of respondents were female, relatively young, had nursing or midwife degrees and had limited experience working in hypertension care. The hospitals differed in terms of number of years of experience of the health care providers working in hypertension care (p=0.003).

Training in hypertension. Results of the perspectives of health care providers regarding training in hypertension care show that nearly all respondents (99%) have participated in a didactic or school-based training on hypertension at some point during their training and/or career (either in the past year or before the past year, Table 2). Almost half (44%) of respondents stated having participated in long-term training (i.e., >1 month course) on hypertension (either in the past year or before the past year), and a significant majority (72%) had received on the job training, in-service or supervision on the management of hypertension at some time in their career (either in the past year or before the past year).

The level of training in hypertension varied by hospital, showing statistically significant differences in having received didactic or school-based training on hypertension in the past year and before the past year ($p<0.001$ for both); in having received long-term training (> 1 month) before the past year ($p=0.014$), and having received on job training, in service or supervision on the management of hypertension in the past year ($p=0.008$) and never ($p=0.002$). Finally, almost all respondents reported the need for additional training in hypertension (99%) without statistically significant differences between hospitals.

Internal reliability of COACH tool. Overall, the COACH tool showed very good to high internal consistency (Cronbach's α range: 0.57-0.92; Table 3) with all but three dimensions exceeding the accepted standard for satisfactory internal reliability of >0.70 for new scales. The highest Cronbach's α estimates (0.92) was for *Leadership* and the lowest (0.57) was for *Informal payment*. After removal of two items from the *Informal Payments* subscale (i.e., "Efforts are made to stop clients from providing informal payment to get appropriate healthcare services in hypertension" and "Efforts are made to stop health workers from asking clients for informal payment for hypertension"), Cronbach's α increased to 0.74. Similarly, for the *Work Culture* subscale, removal

of one item (i.e., "This facility helps me to improve and develop my skills in hypertension") resulted in a Cronbach's alpha increase from 0.69 to 0.75. Finally, for *Sources of Knowledge*, removal of any of the constituent items did not improve Cronbach's alpha from 0.67.

COACH subscales. The *Organizational Resources* received a mean score of 3.1, suggesting that respondents were overall neutral about this scale (Tables 4 and 5). The majority of respondents stated their agreement with only three of eleven dimensions, including "facility has access to transport and fuel that are needed to provide healthcare services for HTN" (50% agreed), "facility has access to the communication tools that are needed to provide healthcare services for HTN (54%), and the "facility has enough disposable medical equipment to provide healthcare services for HTN" (83% agreed). For the remaining eight dimensions, greater than 50% of respondents were either neutral or disagreed with the dimensions dealing with *Human Resources, Space*, *Medicine and Equipment* and *Financing*, suggesting that there is room for improvement in these areas.

The *Community Engagement* received a mean score of 3.5, suggesting that respondents were slightly more favorable than neutral about the commitment of their hospitals towards their community (Table 5). In fact, four of the five dimensions had more than half of the respondents agreeing with community engagement in hypertension care, with only one dimension, "in this facility, we encourage other organizations to contribute to improving HTN in the community" showing a majority being either neutral (36%) or disapproving (27%).

The *Monitoring Services for Action* received a mean score of 3.2, suggesting that respondents were neutral about the use of monitoring services for hypertension care. Of the five dimensions, only one, "this facility regularly compares its work with national or other guidelines for HTN" (61%) showed agreement by more than half of the respondents.

The *Commitment to Work* received a mean score of 4.2, suggesting that respondents are committed to their hospitals. All three dimensions showed approval by a significant majority (ranging from 70% to 94%).

The *Leadership* subscale received a mean score of 4.1, suggesting that respondents are supportive of their leadership. All six dimensions had more than half of the respondents (81% to 92%) agreeing with high remarks for their leadership.

The *Informal Payment* received a mean score of 4.7, suggesting that respondents do not have concerns with informal payments, nepotism or accountability. In fact, in six of eight dimensions, more than half of the respondents (83% to 98%) indicated no concerns with these issues. However, in the dimension of *Accountability* the low mean score of 2.8 is also reflected by a majority of combined neutral and disagree responses regarding "efforts are made to stop clients from providing informal payment to get appropriate healthcare services in HTN" (22% and 44%, respectively), and "efforts are made to stop health workers from asking clients for informal payment for HTN" (18% and 44%, respectively).

The *Sources of Knowledge* received a mean score of 0.6 (scale range: range 0-1), with discordant result in three of five dimensions: while a majority agreed that they have access to information regarding hypertension guidelines, stating agreed for "clinical practice guidelines for HTN" (61%), "printed material for work with HTN" (54%), and use of "internet for HTN" (50%), the majority responded with either occasionally or never/rarely responses regarding "in-service training/ workshops/courses for HTN" (18% and 46%, respectively) and "electronic decision support for HTN" (13% and 47%, respectively).

Discussion

The purpose of this study was to examine the contextual factors influencing hypertension care at three provincial/district hospitals in Rwanda, ascertained after completion of the COACH tool, a survey validated for use in LMIC, and a questionnaire about training in hypertension. The main findings of the study indicate an overwhelming agreement from the majority of respondents for the increased and/or continuous training in hypertension care, as ascertained in the Training Questionnaire and in the COACH *Knowledge* and *Organizational Resources* subscales.

The high scores in the *Work Culture* and *Leadership* subscales is not surprising to our research team, as we have been collaborating with healthcare providers from these three hospitals for several years. While healthcare respondents in general stated a commitment to work and reported supportive leadership, they also acknowledged challenges with resources and monitoring services. That is, even with such strong leadership in support of hypertension care, respondents stated the need to increase human capacity and improve skills in delivering hypertension care. Additionally, scores on the *Monitoring* subscale indicate that, while they perceive that the hospital leadership can influence change and excellent in practice, they questioned whether the hospital used data to evaluate performance to improve hypertension outcomes.

These findings provide us with contextual guidance for development of training strategies prior to implementation of a comprehensive and sustainable hypertension care program in Rwanda. That is, based on the data, the training program should focus on providing further knowledge and understanding of the hypertension guidelines, and on developing strategies to increase human capacity and monitoring of skills around hypertension care in these hospitals. The results also indicate that we need to develop implementation strategies to support hypertension care in their hospitals and think about how to increase skills on hypertension care and establish a monitoring system to support guideline adherence. As this study is part of long-term capacity building efforts

to strengthening dissemination and implementation science and hypertension science in Rwanda, our team is currently supporting the development of several studies, led by our trainees in Rwanda, to examine implementation strategies to support the hypertension care in these hospitals.

The findings of the COACH tool were illuminating and will guide our next steps, however, the *Informal Payment* and *Sources of Knowledge* subscales exhibited low Cronbach's α internal reliability scores. Other studies have found similar challenges with these subscales indicating that additional work is needed in these subscales.[17] Regarding the subscale *Work Culture,* it is unclear why the item "This facility helps me to improve and develop my skills in hypertension" was challenging in our study. Further cognitive interview with the Kinyarwanda translation of the tool are needed to understand challenges with this item.

There were significant differences in the mean scores across hospitals between the *Organizational Resources, Monitoring Services, Sources of Knowledge, Work Culture, Leadership,* and *Informal Payment* subscales, indicating the tool's ability to identify differences in these contextual factors. Assessment of the context of three hospitals provides guidance for our next training, selection and adaptation of implementation strategies to improve hypertension care in three hospitals in Rwanda. The overall good validity of the COACH tool indicates that it is comprehensible in Kinyarwanda and able to capture differences across settings.

The Context Assessment for Community Health (COACH) tool was originally developed in five LMICs (Bangladesh, Vietnam, Uganda, South Africa, Nicaragua), and more recently applied in Mozambique to assess healthcare context and its potential use for integration of evidence-based interventions and to develop their implementation in clinical practice in LMICs.(16-18) The internal consistency of the COACH tool in a sample of providers in Rwanda, a different country

from where the tool was developed and tested, show its utility to measure contextual dimensions in another LMIC.

Limitations of the study. While we gathered important information for our next steps in terms of context and need for additional training in hypertension care, we did not examine the specific areas where the respondents need training in terms of hypertension care (e.g., epidemiology, diagnosis, treatment). To further examine the hypertension care in these hospitals, we will gather qualitative data through focus groups with our stakeholders. Finally, the internal consistency of the COACH subscales after removal of the items was satisfactory, but further studies need to examine the challenges in the *Informal Payment* subscale and its low Cronbach alpha, also reported in other studies (18).

Conclusions.

Contextual measures related to hypertension care in Rwanda shows a need for increased and/or continuous training. Healthcare responders stated a general commitment to work and reported supportive leadership while acknowledging challenges with resources and monitoring services. COACH tool provides contextual guidance for development of training strategies prior to implementation of a comprehensive and sustainable hypertension care program in Rwanda.

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Eugene Mutimura (EM), Anna Bergström (AB), Aurore Nishimwe (AN), Cecile Ingabire CI), and Victor G. Davila-Roman (VGD-R) conceptualized the study. AAB, CH, and VM organized the survey. VM led COACH tool translation and back translation and was responsible for data collection. CH was responsible for data management. CWG was responsible for data analysis. AAB, CH, CWG and VGD-R drafted initial version of manuscript. All co-authors read, contributed to and approved the final manuscript.

Competing interests statement: The authors declare no competing interest.

Disclosure statement. No potential conflict of interest was reported by any of the authors.

Ethics and consent. This study was approved by University of Rwanda-CMHS Institutional Review Board (approval notice: 099/CMSH IRB 2019) and by Washington University School of Medicine Institutional Review Board Committee (IRB # 201807048). Participants were informed of the potential risks and benefits of the study and signed an informed consent form in Kinyarwanda language before enrolment in the study. All participant data were anonymized to optimize privacy and confidentiality of responses.

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Table 1. Participant demographics reported as n (%).

Variable	Group	All (N = 223)	Hospital A (N=74)	Hospital B (N=70)	Hospital C (N=79)	p value
Age	20-35 years	125 (56%)	40 (54%)	40 (57%)	45 (57%)	0.914
	≥36 years	98 (44%)	34 (46%)	30 (43%)	34 (43%)	
Gender	Female	168 (75%)	51 (69%)	53 (76%)	64 (81%)	0.2
Education	Nurse	142 (64%)	46 (62%)	47 (67%)	49 (62%)	0.811
	Midwife	42 (19%)	17 (23%)	11 (16%)	14 (18%)	
	Primary care physician	28 (13%)	9 (12%)	9 (13%)	10 (13%)	
	Physician specialist	11 (5%)	2 (3%)	3 (4%)	6 (8%)	
Experience working in hypertension care	0-3 years	114 (51%)	32 (43%)	28 (40%)	54 (68%)	0.003
	4-9 years	64 (29%)	27 (37%)	22 (31%)	15 (19%)	
	≥10 years	45 (20%)	15 (20%)	20 (29%)	10 (13%)	

Table 2. Participant hypertension training history reported as number and % of those responding "Yes".

Variable	All (N=223)	Hospital A (N=74)	Hospital B (N=70)	Hospital C (N=79)	p value
Have you received didactic or school-based training on HTN?					
A. In the past year	72 (32%)	34(46%)	24 (34%)	14 (18%)	<.001
B. Before the past year	162 (73%)	42 (57%)	51 (73%)	69 (87%)	<.001
C. Never	3 (1%)	2 (3%)	1 (1%)	0	0.311
Have you received a structured long-term (>1 month course) training on HTN?					
A. In the past year	41 (18%)	18 (24%)	9 (13%)	14 (18%)	0.203
B. Before the past year	58 (26%)	28 (38%)	16 (23%)	14 (18%)	0.014
C. Never	160 (72%)	45 (61%)	54 (77%)	61 (77%)	0.038
Have you received on job training, in-service or supervision on the management of HTN?					
A. In the past year	81 (36%)	33 (45%)	30 (43%)	18 (23%)	0.008
B. Before the past year	79 (36%)	31 (42%)	26 (37%)	22 (28%)	0.18
C. Never	109 (49%)	29 (39%)	29 (41%)	51 (65%)	0.002
Do you feel there is need for additional training in the management of HTN?					
Yes	220 (99%)	73 (99%)	70 (100%)	77 (97%)	0.776

Table 3. Cronbach alpha estimates for the different COACH dimensions.

Dimension	Items	Score range	Cronbach α
Organizational resources	11	1-5	0.83
Community engagement	5	1-5	0.80
Monitoring services for action	5	1-5	0.74
Commitment to work	3	1-5	0.77
Work culture	6	1-5	0.69
Work culture, with questions removed [a]	5	1-5	0.75
Leadership	6	1-5	0.92
Informal payment	8	1-5	0.57
Informal payment, with questions removed [b]	6	1-5	0.74
Sources of knowledge	5	0-1	0.67

Note: a: item: item "This facility helps me to improve and develop my skills in hypertension" removed; b: items "Efforts are made to stop clients from providing informal payment to get appropriate healthcare services in hypertension" and "Efforts are made to stop health workers from asking clients for informal payment for hypertension" were removed.

Table 4. Overall mean ± standard deviation and by hospital for the COACH subscales.

Dimensions	All (N=223)	Hospital A (N=74)	Hospital B (N=70)	Hospital C (N=79)	p value
Organizational resources	**3.1±0.6**	**3.3±0.8**	**2.9±0.5**	**3.1±0.5**	**<0.001**
Human Resources	2.6±1.0	3.2±1.1	2.4±0.9	2.3±0.8	<0.001
Space	3.0±1.1	3.2±1.2	2.7±1.1	3.0±1.1	0.032
Communication and transport	3.3±1.0	3.3±1.1	3.2±1.0	3.4±0.8	0.699
Financing	2.9±0.7	3.1±0.8	2.7±0.6	2.9±0.5	<0.001
Medicines and equipment	3.3±0.8	3.4±0.9	3.0±0.7	3.5±0.7	<0.001
Community engagement	**3.5±0.7**	**3.5±0.8**	**3.4±0.7**	**3.6±0.5**	**0.118**
Monitoring services for action	**3.2±0.6**	**3.3±0.8**	**3.0±0.6**	**3.2±0.5**	**0.001**
Commitment to work	**4.2±0.7**	**4.3±0.6**	**4.2±0.7**	**4.1±0.8**	**0.155**
Work culture	**4.1±0.5**	**4.0±0.7**	**4.0±0.5**	**4.3±0.4**	**0.002**
Culture of learning and change	3.8±0.6	3.8±0.7	3.8±0.7	3.7±0.5	0.768
Culture of responsibility	4.1±0.6	4.0±0.8	4.0±0.5	4.4±0.4	<0.001
Leadership	**4.1±0.7**	**4.1±0.8**	**4.3±0.5**	**3.9±0.7**	**0.01**
Informal payment	**4.7±0.5**	**4.5±0.6**	**4.7±0.4**	**4.8±0.3**	**0.003**
Accountability	2.8±1.5	2.7±1.5	3.5±1.3	2.3±1.3	<0.001
Informal payment*	4.7±0.5	4.6±0.6	4.8±0.4	4.8±0.3	0.002
Nepotism*	4.6±0.6	4.5±0.7	4.6±0.6	4.7±0.6	0.087
Sources of knowledge†	**0.6±0.3**	**0.6±0.3**	**0.5±0.3**	**0.7±0.3**	**0.003**

All values represent mean ± standard deviation. Bolded items indicate COACH subscales; those below the subscales indicate the dimensions within the subscales.
†Score range for Sources of Knowledge is: 0-1; for all other subscales the score range is: 1-5.
*Items on informal payment and Nepotism were reverse-scored.

Table 5. Descriptive values of items and dimensions of the COACH tool in Rwanda (N = 223)

Scaled Dimensions/Items	Mean	Median	Disagree	Neutral	Agree
Organizational resources	3.1	3.0	-	-	-
Human resources	2.6	2.5	-	-	-
This facility has enough workers with the right training and skills to do everything that needs to be done for HTN	2.7	2.0	121 (54%)	43 (19%)	59 (27%)
This facility has enough workers with the right training and skills to do their job in the best possible way for HTN	2.6	2.0	123 (55%)	41 (18%)	59 (27%)
Space	3.0	3.0	-	-	-
This facility has enough space to provide healthcare services for HTN	3.0	3.0	96 (43%)	29 (13%)	98 (44%)
Communication and transport	3.3	3.5	-	-	-
This facility has access to the transport and fuel that are needed to provide healthcare services for HTN	3.3	4.0	60 (27%)	51 (23%)	112 (50%)
This facility has access to the communication tools (e.g. telephones or radios) that are needed to provide healthcare services for HTN	3.3	4.0	65 (29%)	37 (17%)	121 (54%)
Financing	2.9	3.0	-	-	-
This facility receives money according to a budget for HTN	2.9	3.0	42 (19%)	153 (69%)	28 (13%)
This facility has money that we can decide how to use for HTN	2.9	3.0	52 (23%)	140 (63%)	31 (14%)
Medicines and equipment	3.3	3.5	-	-	-
This facility has enough medicine to provide healthcare services for HTN	3.1	3.0	81 (36%)	39 (18%)	103 (46%)
This facility has enough functional equipment to provide healthcare services for HTN	3.1	3.0	80 (35.9%)	38 (17%)	105 (47%)
This facility has enough disposable medical equipment, such as syringes, gloves and needles to provide healthcare services for HTN	4.0	4.0	24 (11%)	15 (7%)	184 (83%)
If the workload increases, the facility can get additional resources such as medicine and equipment for HTN	3.1	3.0	59 (27%)	84 (38%)	80 (36%)
Community engagement	3.5	3.6	-	-	-

In this facility, we ask community members what they think about the healthcare services that we provide for HTN	3.3	4.0	46 (21%)	63 (28%)	114 (51%)
In this facility, we listen to what community members think about the healthcare services we provide for HTN	3.7	4.0	30 (14%)	41 (18%)	152 (68%)
In this facility, we have meetings with community members to discuss health matters regarding HTN	3.6	4.0	30 (14%)	48 (22%)	145 (65%)
In this facility, we encourage community members to contribute to improving HTN in the community	3.7	4.0	29 (13%)	33 (15%)	161 (72%)
In this facility, we encourage other organizations to contribute to improving HTN in the community	3.3	3.0	44 (20%)	81 (36%)	98 (44%)
Monitoring services for action	3.2	3.2	-	-	-
I receive regular updates about the facility's performance on HTN based on information/data collected from our facility	2.7	3.0	110 (49%)	51 (23%)	62 (28%)
This facility discusses information/data from our facility on HTN in a regular, formal way, such as in regularly scheduled meetings	3.2	3.0	60 (27%)	73 (33%)	90 (41%)
This facility regularly uses facility information/data to make plans for improving its healthcare services for HTN	3.1	3.0	41 (18%)	108 (48%)	74 (33%)
This facility regularly monitors its work by comparing it with the facility's action plans for HTN	3.2	3.0	30 (14%)	117 (53%)	76 (34%)
This facility regularly compares its work with national or other guidelines for HTN	3.6	4.0	19 (9%)	68 (31%)	136 (61%)
Commitment to work	4.2	4.3	-	-	-
I am proud to work in this facility	4.0	4.0	16 (7%)	24 (11%)	183 (82%)
I am satisfied to work in this facility	3.9	4.0	24 (11%)	23 (10%)	176 (79%)
I feel encouraged to do my very best at work	4.6	5.0	6 (3%)	8 (4%)	209 (94%)
Work culture	4.1	4.2	-	-	-
Culture of learning and change	3.8	3.7	-	-	-
This facility is willing to use new healthcare practices such as guidelines and recommendations for HTN	3.9	4.0	8 (4%)	45 (20%)	170 (76%)
This facility helps me to improve and develop my skills in HTN	3.1	3.0	87 (39%)	37 (17%)	99 (44%)
I am encouraged to seek new information on healthcare practices for HTN	4.4	4.0	7 (3%)	13 (6%)	203 (91%)
Culture of responsibility	4.1	4.0	-	-	-

This facility works for the good of the clients and puts their needs first in treatment of HTN	3.8	4.0	17 (8%)	51 (23%)	155 (70%)
Members of the facility feel personally responsible for improving healthcare services for HTN	4.2	4.0	3 (1%)	34 (15%)	186 (83%)
Members of the facility approach clients with HTN with respect	4.4	4.0	3 (1%)	10 (5%)	210 (94%)
Leadership	4.1	4.0	-	-	-
I trust the facility leader	4.2	4.0	9 (4%)	11 (5%)	203 (91%)
The leader handles stressful situations calmly	4.0	4.0	13 (6%)	26 (12%)	184 (83%)
The leader actively listens, acknowledges, and then responds to requests and concerns	4.0	4.0	14 (6%)	22 (10%)	187 (84%)
The leader effectively resolves any conflicts that arise	4.1	4.0	9 (4%)	16 (7%)	198 (89%)
The leader encourages the introduction of new ideas and practices	4.2	4.0	6 (3%)	13 (6%)	204 (92%)
The leader makes things happen	4.0	4.0	11 (5%)	32 (14%)	180 (81%)
Informal payment	4.7	4.8	-	-	-
Informal payment	4.7	5.0	-	-	-
Clients must always give informal payment to health workers to access healthcare services for HTN	4.9	5.0	1 (0.4%)	3 (1%)	219 (98%)
Clients are treated more quickly if they make informal payments to health workers for HTN	4.9	5.0	3 (1%)	5 (2%)	215 (96%)
Medicines or equipment for HTN that should be available for free to clients have been sold in this facility	4.6	5.0	5 (2%)	24 (11%)	194 (87%)
Health workers are sometimes absent from work earning money at other places	4.5	5.0	5 (2%)	34 (15%)	184 (83%)
Nepotism	4.6	5.0	-	-	-
Health workers in this facility give healthcare services for HTN to friends and family first	4.7	5.0	4 (2%)	10 (5%)	209 (94%)
Health workers in this facility give jobs or other benefits to friends and family first	4.5	5.0	10 (5%)	28 (13%)	185 (83%)
Accountability	2.8	3.0	-	-	-
Efforts are made to stop clients from providing informal payment to get appropriate healthcare services in HTN	2.8	3.0	99 (44%)	49 (22%)	75 (34%)
Efforts are made to stop health workers from asking clients for informal payment for HTN	2.8	3.0	97 (44%)	40 (18%)	86 (39%)

Non-scaled dimension/items	Mean	Median	NA, never, rarely	Occasionally	Frequently, always
Sources of Knowledge	0.6	0.6	-	-	-
Clinical practice guidelines for HTN	0.7	1.0	52 (23%)	35 (16%)	136 (61%)
Other printed material for work (e.g. textbooks, journals) with HTN	0.6	1.0	58 (26%)	45 (20%)	120 (54%)
In-service training/ workshops/courses for HTN	0.5	0.5	102 (46%)	41 (18%)	80 (36%)
The Internet for HTN	0.6	0.5	65 (29%)	47 (21%)	111 (50%)
Electronic decision support (e.g. mobile phone applications or other electronic devices to assist with care and decision-making) for HTN	0.5	0.5	105 (47%)	28 (13%)	90 (40%)

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	4-5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5-6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7-8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6-8
Bias	9	Describe any efforts to address potential sources of bias	5
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7-8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7-8
		(*b*) Describe any methods used to examine subgroups and interactions	7-8
		(*c*) Explain how missing data were addressed	7-8
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	n/a
		(*e*) Describe any sensitivity analyses	n/a
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	n/a
		(c) Consider use of a flow diagram	n/a
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8-9
		(b) Indicate number of participants with missing data for each variable of interest	n/a
Outcome data	15*	Report numbers of outcome events or summary measures	9-11
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	

		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	9-11
Discussion			
Key results	18	Summarise key results with reference to study objectives	11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13
Generalisability	21	Discuss the generalisability (external validity) of the study results	11-13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Exploring contextual factors influencing the implementation of evidence-based care for hypertension in Rwanda: A cross-sectional study using the COACH questionnaire

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Title: Exploring contextual factors influencing the implementation of evidence-based care for hypertension in Rwanda: A cross-sectional study using the COACH questionnaire

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Abstract

Importance: Hypertension is the largest contributor to the Global Burden of Disease. In Rwanda, as in most low- and middle-income countries, an increasing prevalence of hypertension and its associated morbidity and mortality is causing major health care and economic impact. Understanding healthcare systems context in hypertension care is necessary.

Objective: To study the hypertension healthcare context as perceived by healthcare providers using the Context Assessment for Community Health (COACH) tool.

Design: A cross-sectional cohort responded to the COACH questionnaire and a survey about HTN training.

Setting: Three tertiary care hospitals in Rwanda.

Participants: Healthcare professionals (n=223).

Primary Outcome(s) and Measure(s): The COACH tool consists of 49 items with eight subscales: Resources, Community Engagement, Commitment to Work, Informal Payment, Leadership, Work Culture, Monitoring Services for Action (5-point Likert scale) and Sources of Knowledge (on a 0-1 scale). Four questions surveyed training on hypertension.

Results: Responders (n=223, 75% women; 56% aged 20-35 years) included nurses (n=142, 64%, midwives (n=42, 19%), primary care physicians (n=28, 13%) and physician specialists (n=11, 5%). The subscales Commitment to Work, Leadership, Work Culture and Informal Payment scored between 4.7 and 4.1, the Community Engagement, Monitoring Services for Action and Organizational Resources scored between 3.1 and 3.5. Sources of Knowledge had a mean score of 0.6±0.3. While 73% reported having attended a didactic hypertension seminar in the past year, only 28% had received long-term training, and 51% had <3 years experience working with

hypertension care delivery. The majority (99%) indicated a need for additional training in hypertension care.

Conclusions: There is a need for increased and continuous training in Rwanda. Healthcare responders stated a commitment to work and reported supportive leadership, while acknowledging limited resources and no monitoring systems. The COACH tool provides contextual guidance to develop training strategies prior to implementation of a sustainable hypertension care program.

Key words: Hyperthension, Rwanda, contextual assessment, guidelines, education and training

Strengths and Liminations of the Study:

- A cross-sectional cohort of providers from three hospitals in Rwanda responded to the Context Assessment for Community Health (COACH) tool and a survey examining existing training in hypertension care.
- Respondents shared a high commitment to work and positive leadership, while indicating the need for more training in hypertension care and monitoring.
- Based on the COACH tool training, strategies are being co-developed to implement a comprehensive and sustainable hypertension care program in Rwanda.

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Background

Hypertension is the most common disease in the world affecting globally over 1.2 billion people, is the largest contributor to the Global Burden of Disease, and is the most prevalent risk factor for the development of cardiovascular disease (CVD).[1–3] The overall global prevalence of hypertension exceeds 50% of adults older than 50 years, and in low- and middle-income countries (LMICs) ranges from 32%-78%.[4–7] Rwanda, located in sub-Saharan Africa, is a LMIC with 12.4 million relatively young people (those <34 years of age represent 78% of the population), and with a high population density.[7,8] Rwanda is undergoing an epidemiological transition with an increasing co-existence of infectious diseases and non-communicable diseases (NCDs) including hypertension.[8,9] Epidemiologic data from Rwanda estimates a high prevalence of both hypertension and CVD, which together account for 36% of deaths.[10] The 2015 Rwanda NCDs risk survey based on the World Health Organization (WHO) STEPS framework (STEPwise Approach to Surveillance) reported an overall hypertension prevalence of 15% (95% confidence interval [CI]: 13.8 to 16.3) for those aged 15 to 64 years and 39% (95% CI: 35.7 to 43.1) for those aged 55–64 years, with deaths attributable to hypertension at 18/100,000.[11] These data are consistent with those of other sub-Saharan countries, reflecting the importance of hypertension as a public health burden in Sub-Saharan Africa.[12]

While evidence-based intervention (EBI) studies have shown that treatment and control of hypertension decreases morbidity and mortality, barriers for the implementation of these interventions have been found at all healthcare levels, including systems, providers, and patients.[13] The application of dissemination and implementation (D&I) science allows for a rigorous and systematic approach to develop implementation strategies and improve the uptake of effective EBIs for hypertension care.[14]

Selection of implementation strategies, that is, methods to implememt these EBIs in usual care, should be based on frameworks and on an understanding of the context where the intervention will be implemented.[15] The Promoting Action on Research Implementation in Health Services (PARIHS) is a framework that outlines three core elements (evidence, context and facilitation) for successful EBI implementation[14-15]. Context, defined as "the environment or setting in which the proposed change is to be implemented" is comprised of three sub-elements: culture, leadership and evaluation, dimensions being evaluated in this study.[14-15] The Context Assessment for Community Health (COACH), a validated theory-based tool aimed at examining healthcare contexts in LMICs, is a 49-item survey based on the context dimension of the PARIHS framework and the interconnected building blocks of the World Health Organization.[16] The COACH tool was developed to identify barriers for EBI implementation, to guide planning and adaptation of the strategies to increase the uptake of the EBIs, and to link contextual characteristics to outcome indicators of healthcare interventions.[16] Due to its theoretical base and its acceptable reliability and validity among providers in a variety of LMICs including Vietnam, Bangladesh, Uganda, South Africa, and Nicaragua[16,17], COACH was used in the present study to examine the context of hypertension care as reported by healthcare providers from three hospitals in Rwanda.

Methods

Study setting. The study was conducted at three hospitals (two district, one provincial) in Rwanda; to maintain the confidentiality of participants the hospitals are identified as A, B and C. The study was approved by the University of Rwanda CMHS Institutional Review Board and by the Washington University School of Medicine Institutional Review Board Committee.

Participants. Participants were healthcare providers working in the included hospitals. Lists of all medical professional staff (nursing, midwives, physicians) were provided by the hospital

administrations to the study team; from these lists, study participants were contacted to participate in the study. All those who were contacted agreed to participate, all signed informed consent, and subsequently underwent in-person interviews to complete the survey.

Questions about provider training in hypertension. A separate survey asked health care providers four questions regarding training in hypertension care: i) have you received didactic or school-based training on hypertension? (response options for first three questions: in the past year, before the past year, never); ii) have you received a structured long-term (>1 month course) training on hypertension?; iii) have you received on job training, in-service or supervision on the management of hypertension?; and iv) do you feel there is need for additional training in the management of hypertension? (response options: yes, no/not sure).

Questions about health care system context. The COACH tool consists of 49 questions across eight subscales. *Organizational Resources* refers to the availability of human capacity and materials that allow an organization to implement an intervention successfully. *Community Engagement* refers to mutual communication and activities that occur between community members and the organization. *Monitoring* refers to the process of using locally derived data to evaluate performance and plans to improve outcomes. *Sources of Knowledge* refers to the availability and use of sources of facts, information, and skills acquired by providers through experience or education in an organization that facilitate best practice. *Commitment to Work* refers to an individual identification with and involvement in an organization. *Work Culture* refers to the process of an organization, reflecting a shared set of values, ideas, concepts and rules of behavior that allow the organization to function. *Leadership* refers to the actions of a person in the organization who can influence change and excellence in practice, achieved through clarity and engagement. *Informal Payment* refers to bribe and/or benefits given to an individual outside of the

officially accepted arrangements.[16] Respondents were asked to rate their level of agreement using a five-point Likert scale for all items, except for items in the *Sources of Knowledge* subscale where the scale is from 0 to 1, regarding the use of the hypertension guidelines within a specified time frame and the availability of different sources of knowledge.

Translation and adaptation of COACH tool. The majority of healthcare workers in Rwanda do not routinely communicate in English. For this reason, the COACH tool was translated from English to Kinyarwanda (study participants' daily language), and subsequently back translated to English by two Rwandan bilingual experts in both English and Kinyarwanda, following the World Health Organization guidelines for translation of assessments[18] to ensure the accuracy of the translation. Items that needed further clarification after pilot testing were discussed with the tool developer and agreement on the translation was reached by consensus. Additionally, we adapted the questions to be specific in relation to hypertension care (e.g., "This facility is willing to use new healthcare practices such as guidelines and recommendations for HTN").

Patient and Public Involvement: The COACH questionnaire has been previously validated in LMICs and was modified by the research team to address the context of hypertension in Rwanda through our weekly calls. The Rwandan co-investigators had primary responsibility for the translation (English to Kinyarwanda) and back-translation of the COACH questionnaire and for development, recruitment and conduction of the study. Patients were not involved in the development, recruitment or conduction of the study. The results of this study has been shared with stakeholders in Rwanda through our yearly meetings. Additional dissemination with the ministry of Health, academic institutions, health care providers and others will occur once the manuscript is published.

Data collection. Data were collected by in-person interviews, using structured questionnaires in paper and pencil format, and subsequently transferred in duplicate entry to Qualtrics by members of the research team. There were no missing values for any of the questions and any discrepancies in data entry were resolved. The survey was administered between May 27 through June 4, 2019.

Analysis. Demographics are reported as the total number of respondents and percentage in each group. Differences among hospitals were assessed using chi-square tests or Fisher's exact tests as appropriate. COACH dimensions are reported as means ± standard deviation, for each hospital and combined across all hospitals. Cronbach's α, a coefficient of reliability, was used to determine internal consistency of the test items and the average inter-correlation between the items in each dimension. Scoring of sources of knowledge dimension ranged from 0 (not available, never/rarely), 0.5 (occasionally), to 1 (frequently/always); scoring for the other subscales ranged from 1 (strongly disagree) to 5 (strongly agree). The first six items in the informal payment dimension were reverse-scored so that the directional interpretation was similar to the other dimensions.

A one-way analysis of variance (ANOVA) was used to test for differences in mean dimension scores among the three hospitals. All analyses were conducted using SAS, 9.4 (SAS Institute Inc., Cary, NC, USA) and *P*-values < 0.05 were considered significant.

Results

The total number of respondents (n=223) included nurses, midwives, primary care physicians and specialty physicians, with approximately similar representation obtained from all three hospitals (Table 1). The majority of respondents were female, relatively young, had nursing or midwife degrees and had limited experience working in hypertension care. The hospitals differed in terms

of number of years of experience of the health care providers working in hypertension care (p=0.003).

Training in hypertension. Results of the perspectives of health care providers regarding training in hypertension care show that nearly all respondents (99%) have participated in a didactic or school-based training on hypertension at some point during their training and/or career (either in the past year or before the past year, Table 2). Almost half (44%) of respondents stated having participated in long-term training (i.e., >1 month course) on hypertension (either in the past year or before the past year), and a significant majority (72%) had received on the job training, in-service or supervision on the management of hypertension at some time in their career (either in the past year or before the past year).

The level of training in hypertension varied by hospital, showing statistically significant differences in having received didactic or school-based training on hypertension in the past year and before the past year ($p<0.001$ for both); in having received long-term training (> 1 month) before the past year (p=0.014), and having received on job training, in service or supervision on the management of hypertension in the past year (p=0.008) and never (p=0.002). Finally, almost all respondents reported the need for additional training in hypertension (99%) without statistically significant differences between hospitals.

Internal reliability of COACH tool. Overall, the COACH tool showed very good to high internal consistency (Cronbach's α range: 0.57-0.92; Table 3) with all but three dimensions exceeding the accepted standard for satisfactory internal reliability of >0.70 for new scales. The highest Cronbach's α estimates (0.92) was for *Leadership* and the lowest (0.57) was for *Informal payment*. After removal of two items from the *Informal Payments* subscale (i.e., "Efforts are made to stop clients from providing informal payment to get appropriate healthcare services in hypertension"

and "Efforts are made to stop health workers from asking clients for informal payment for hypertension"), Cronbach's α increased to 0.74. Similarly, for the *Work Culture* subscale, removal of one item (i.e., "This facility helps me to improve and develop my skills in hypertension") resulted in a Cronbach's alpha increase from 0.69 to 0.75. Finally, for *Sources of Knowledge*, removal of any of the constituent items did not improve Cronbach's alpha from 0.67.

COACH subscales. Table 4 shows the mean and standard deviations for the scales across hospitals. There were significant differences in the mean scores across hospitals between the *Organizational Resources, Monitoring Services, Sources of Knowledge, Work Culture, Leadership,* and *Informal Payment* subscales.

The *Organizational Resources* received a mean score of 3.1, suggesting that respondents were overall neutral about this scale (Tables 4 and 5). The majority of respondents agreed with only three of eleven dimensions, including "facility has access to transport and fuel that are needed to provide healthcare services for HTN" (50% agreed), "facility has access to the communication tools that are needed to provide healthcare services for HTN (54%), and the "facility has enough disposable medical equipment to provide healthcare services for HTN" (83% agreed). For the remaining eight dimensions, greater than 50% of respondents were either neutral or disagreed with the dimensions dealing with *Human Resources, Space*, *Medicine and Equipment* and *Financing*, suggesting that there is room for improvement in these areas.

The *Community Engagement* received a mean score of 3.5, suggesting that respondents were slightly more favorable than neutral about the commitment of their hospitals towards their community (Table 5). In fact, four of the five dimensions had more than half of the respondents agreeing with community engagement in hypertension care, with only one dimension, "in this

facility, we encourage other organizations to contribute to improving HTN in the community" showing a majority being either neutral (36%) or disapproving (27%).

The *Monitoring Services for Action* received a mean score of 3.2, suggesting that respondents were neutral about the use of locally derived data to evaluate the performance and plans to improve hypertension care. Of the five dimensions, only one, "this facility regularly compares its work with national or other guidelines for HTN" (61%) showed agreement by more than half of the respondents.

The *Commitment to Work* received a mean score of 4.2, suggesting that respondents are committed to their hospitals. All three dimensions showed approval by a significant majority (ranging from 70% to 94%).

The *Leadership* subscale received a mean score of 4.1, suggesting that respondents are supportive of their leadership. All six dimensions had more than half of the respondents (81% to 92%) agreeing with high remarks for their leadership.

The *Informal Payment* received a mean score of 4.7, suggesting that respondents do not have concerns with informal payments, nepotism or accountability. In fact, in six of eight dimensions, more than half of the respondents (83% to 98%) indicated no concerns with these issues. However, in the dimension of *Accountability* the low mean score of 2.8 is also reflected by a majority of combined neutral and disagree responses regarding "efforts are made to stop clients from providing informal payment to get appropriate healthcare services in HTN" (22% and 44%, respectively), and "efforts are made to stop health workers from asking clients for informal payment for HTN" (18% and 44%, respectively).

The *Sources of Knowledge* received a mean score of 0.6 (scale range: range 0-1), with discordant result in three of five dimensions: while a majority agreed that they have access to information

regarding hypertension guidelines, stating agreement for "clinical practice guidelines for HTN" (61%), "printed material for work with HTN" (54%), and use of "internet for HTN" (50%), the majority responded with either occasionally or never/rarely responses regarding "in-service training/ workshops/courses for HTN" (18% and 46%, respectively) and "electronic decision support for HTN" (13% and 47%, respectively).

Discussion

The purpose of this study was to examine the contextual factors influencing hypertension care at three provincial/district hospitals in Rwanda, ascertained after completion of the COACH tool, a survey validated for use in LMIC, and a questionnaire about training in hypertension. The main findings of the study indicate an overwhelming agreement from the majority of respondents for increased and/or continuous training in hypertension care, as ascertained in the Training Questionnaire and in the COACH *Knowledge* and *Organizational Resources* subscales.

Our research team has been collaborating with healthcare providers from these hospitals for several years prior to survey, which may explain the high scores in the *Work Culture* and *Leadership* subscales. While healthcare respondents in general stated a commitment to work and reported supportive leadership, the lower scores in the *Resources* and *Monitoring Services* scales indicate challenges and opportunities for growth in these areas. In other words, even with such strong leadership in support of hypertension care, only about half of the respondents agreed with items that stated that the hospital had enough workers with the proper training and skills for HTN care. Additionally, the low scores on the *Monitoring* subscale indicate that respondents believe that the hospital could improve evaluations of personnel performance with the purpose of improving hypertension outcomes.

These findings provide us with contextual guidance for development of training strategies prior to implementation of a comprehensive and sustainable hypertension care program in Rwanda. That is, based on the data, the training program should focus on providing further knowledge and understanding of the hypertension guidelines, and on developing strategies to increase human capacity and monitoring of skills around hypertension care in these hospitals. The results also indicate that we need to develop implementation strategies to support hypertension care in these hospitals and to think about how to increase skills on hypertension care and establish a monitoring system to support guideline adherence. The findings of this study reflect a larger historical context in Rwanda, with a shortage of trained physians trained, especially after the 1996 Genocide.[19] Accordingly, recently there has been a national movement for nurse-led task sharing of HTN care.[19,20]

The findings of the COACH tool will guide our next steps in developing capacity building strategies and supporting the hospitals in establishing monitoring systems for HTN care. However, the *Informal Payment* and *Sources of Knowledge* subscales exhibited low Cronbach's α internal reliability scores. Other studies have found similar challenges with these subscales indicating that additional work is needed in these subscales.[21] Regarding the subscale *Work Culture,* it is unclear why the item "This facility helps me to improve and develop my skills in hypertension" was challenging in our study. Further cognitive interview with the Kinyarwanda translation of the tool are needed to understand challenges with this item.

There were significant differences in the mean scores across hospitals between the *Organizational Resources, Monitoring Services, Sources of Knowledge, Work Culture, Leadership,* and *Informal Payment* subscales, indicating the tool's ability to identify differences in these contextual factors. Assessment of the context of three hospitals provides guidance for our next training, selection and

adaptation of implementation strategies to improve hypertension care in three hospitals in Rwanda. The overall good validity of the COACH tool indicates that it is comprehensible in Kinyarwanda and able to capture differences across settings.

The Context Assessment for Community Health (COACH) tool was originally developed in five LMICs (Bangladesh, Vietnam, Uganda, South Africa, Nicaragua), and more recently applied in Mozambique to assess healthcare context and its potential use for integration of evidence-based interventions and to develop their implementation in clinical practice in LMICs[16,17]. The internal consistency of the COACH tool in a sample of providers in Rwanda, a different country from where the tool was developed and tested, show its utility to measure contextual dimensions in another LMIC. As this study is part of long-term capacity building efforts to strengthening dissemination and implementation science and hypertension science in Rwanda, our team is currently supporting the development of several studies, led by investigators in Rwanda, to examine implementation strategies to support the hypertension care in these hospitals.

Limitations of the study. While we gathered important information for our next steps in terms of context and the need for additional training in hypertension care, we did not examine the specific areas where the respondents need training in terms of hypertension care (e.g., epidemiology, diagnosis, treatment). To further examine the hypertension care in these hospitals, we will gather qualitative data through focus groups with our stakeholders. Additionally, while between hospitals analyses of the scores were done, our team is unable to report these to avoid breach of confidentiality. This information has been shared with hospital leadership in a confidential manner so they can incorporate and support hypertension training in strategic planning. Finally, the internal consistency of the COACH subscales after removal of the items was satisfactory, but further

studies need to examine the challenges in the *Informal Payment* subscale and its low Cronbach alpha, also reported in other studies.[17]

Conclusions.

Contextual measures related to hypertension care in Rwanda shows a need for increased and/or continuous training. Healthcare responders stated a general commitment to work and reported supportive leadership while acknowledging challenges with resources and monitoring services. COACH tool provides contextual guidance for development of training strategies prior to implementation of a comprehensive and sustainable hypertension care program in Rwanda.

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Data availability. No additional data is available. Data are available upon reasonable request to the corresponding author.

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Table 1. Participant demographics reported as n (%).

Variable	Group	All (N = 223)	Hospital A (N=74)	Hospital B (N=70)	Hospital C (N=79)	p value
Age	20-35 years	125 (56%)	40 (54%)	40 (57%)	45 (57%)	0.914
	≥36 years	98 (44%)	34 (46%)	30 (43%)	34 (43%)	
Gender	Female	168 (75%)	51 (69%)	53 (76%)	64 (81%)	0.2
Education	Nurse	142 (64%)	46 (62%)	47 (67%)	49 (62%)	0.811
	Midwife	42 (19%)	17 (23%)	11 (16%)	14 (18%)	
	Primary care physician	28 (13%)	9 (12%)	9 (13%)	10 (13%)	
	Physician specialist	11 (5%)	2 (3%)	3 (4%)	6 (8%)	
Experience working in hypertension care	0-3 years	114 (51%)	32 (43%)	28 (40%)	54 (68%)	0.003
	4-9 years	64 (29%)	27 (37%)	22 (31%)	15 (19%)	
	≥10 years	45 (20%)	15 (20%)	20 (29%)	10 (13%)	

Table 2. Participant hypertension training history reported as number and % of those responding "Yes".

Variable	All (N=223)	Hospital A (N=74)	Hospital B (N=70)	Hospital C (N=79)	p value
Have you received didactic or school-based training on HTN?					
A. In the past year	72 (32%)	34(46%)	24 (34%)	14 (18%)	<.001
B. Before the past year	162 (73%)	42 (57%)	51 (73%)	69 (87%)	<.001
C. Never	3 (1%)	2 (3%)	1 (1%)	0	0.311
Have you received a structured long-term (>1 month course) training on HTN?					
A. In the past year	41 (18%)	18 (24%)	9 (13%)	14 (18%)	0.203
B. Before the past year	58 (26%)	28 (38%)	16 (23%)	14 (18%)	0.014
C. Never	160 (72%)	45 (61%)	54 (77%)	61 (77%)	0.038
Have you received on job training, in-service or supervision on the management of HTN?					
A. In the past year	81 (36%)	33 (45%)	30 (43%)	18 (23%)	0.008
B. Before the past year	79 (36%)	31 (42%)	26 (37%)	22 (28%)	0.18
C. Never	109 (49%)	29 (39%)	29 (41%)	51 (65%)	0.002
Do you feel there is need for additional training in the management of HTN?					
Yes	220 (99%)	73 (99%)	70 (100%)	77 (97%)	0.776

Table 3. Cronbach alpha estimates for the different COACH dimensions.

Dimension	Items	Score range	Cronbach α
Organizational resources	11	1-5	0.83
Community engagement	5	1-5	0.80
Monitoring services for action	5	1-5	0.74
Commitment to work	3	1-5	0.77
Work culture	6	1-5	0.69
Work culture, with questions removed [a]	5	1-5	0.75
Leadership	6	1-5	0.92
Informal payment	8	1-5	0.57
Informal payment, with questions removed [b]	6	1-5	0.74
Sources of knowledge	5	0-1	0.67

Note: a: item: item "This facility helps me to improve and develop my skills in hypertension" removed; b: items "Efforts are made to stop clients from providing informal payment to get appropriate healthcare services in hypertension" and "Efforts are made to stop health workers from asking clients for informal payment for hypertension" were removed.

Table 4. Overall mean ± standard deviation and by hospital for the COACH subscales.

Dimensions	All (N=223)	Hospital A (N=74)	Hospital B (N=70)	Hospital C (N=79)	p value
Organizational resources	**3.1±0.6**	**3.3±0.8**	**2.9±0.5**	**3.1±0.5**	**<0.001**
Human Resources	2.6±1.0	3.2±1.1	2.4±0.9	2.3±0.8	<0.001
Space	3.0±1.1	3.2±1.2	2.7±1.1	3.0±1.1	0.032
Communication and transport	3.3±1.0	3.3±1.1	3.2±1.0	3.4±0.8	0.699
Financing	2.9±0.7	3.1±0.8	2.7±0.6	2.9±0.5	<0.001
Medicines and equipment	3.3±0.8	3.4±0.9	3.0±0.7	3.5±0.7	<0.001
Community engagement	**3.5±0.7**	**3.5±0.8**	**3.4±0.7**	**3.6±0.5**	**0.118**
Monitoring services for action	**3.2±0.6**	**3.3±0.8**	**3.0±0.6**	**3.2±0.5**	**0.001**
Commitment to work	**4.2±0.7**	**4.3±0.6**	**4.2±0.7**	**4.1±0.8**	**0.155**
Work culture	**4.1±0.5**	**4.0±0.7**	**4.0±0.5**	**4.3±0.4**	**0.002**
Culture of learning and change	3.8±0.6	3.8±0.7	3.8±0.7	3.7±0.5	0.768
Culture of responsibility	4.1±0.6	4.0±0.8	4.0±0.5	4.4±0.4	<0.001
Leadership	**4.1±0.7**	**4.1±0.8**	**4.3±0.5**	**3.9±0.7**	**0.01**
Informal payment	**4.7±0.5**	**4.5±0.6**	**4.7±0.4**	**4.8±0.3**	**0.003**
Accountability	2.8±1.5	2.7±1.5	3.5±1.3	2.3±1.3	<0.001
Informal payment*	4.7±0.5	4.6±0.6	4.8±0.4	4.8±0.3	0.002
Nepotism*	4.6±0.6	4.5±0.7	4.6±0.6	4.7±0.6	0.087
Sources of knowledge†	**0.6±0.3**	**0.6±0.3**	**0.5±0.3**	**0.7±0.3**	**0.003**

All values represent mean ± standard deviation. Bolded items indicate COACH subscales; those below the subscales indicate the dimensions within the subscales.
†Score range for Sources of Knowledge is: 0-1; for all other subscales the score range is: 1-5.
*Items on informal payment and Nepotism were reverse-scored.

Table 5. Descriptive values of items and dimensions of the COACH tool in Rwanda (N = 223)

Scaled Dimensions/Items	Mean	Median	Disagree	Neutral	Agree
Organizational resources	3.1	3.0	-	-	-
Human resources	2.6	2.5	-	-	-
This facility has enough workers with the right training and skills to do everything that needs to be done for HTN	2.7	2.0	121 (54%)	43 (19%)	59 (27%)
This facility has enough workers with the right training and skills to do their job in the best possible way for HTN	2.6	2.0	123 (55%)	41 (18%)	59 (27%)
Space	3.0	3.0	-	-	-
This facility has enough space to provide healthcare services for HTN	3.0	3.0	96 (43%)	29 (13%)	98 (44%)
Communication and transport	3.3	3.5	-	-	-
This facility has access to the transport and fuel that are needed to provide healthcare services for HTN	3.3	4.0	60 (27%)	51 (23%)	112 (50%)
This facility has access to the communication tools (e.g. telephones or radios) that are needed to provide healthcare services for HTN	3.3	4.0	65 (29%)	37 (17%)	121 (54%)
Financing	2.9	3.0	-	-	-
This facility receives money according to a budget for HTN	2.9	3.0	42 (19%)	153 (69%)	28 (13%)
This facility has money that we can decide how to use for HTN	2.9	3.0	52 (23%)	140 (63%)	31 (14%)
Medicines and equipment	3.3	3.5	-	-	-
This facility has enough medicine to provide healthcare services for HTN	3.1	3.0	81 (36%)	39 (18%)	103 (46%)
This facility has enough functional equipment to provide healthcare services for HTN	3.1	3.0	80 (35.9%)	38 (17%)	105 (47%)
This facility has enough disposable medical equipment, such as syringes, gloves and needles to provide healthcare services for HTN	4.0	4.0	24 (11%)	15 (7%)	184 (83%)
If the workload increases, the facility can get additional resources such as medicine and equipment for HTN	3.1	3.0	59 (27%)	84 (38%)	80 (36%)
Community engagement	3.5	3.6	-	-	-

In this facility, we ask community members what they think about the healthcare services that we provide for HTN	3.3	4.0	46 (21%)	63 (28%)	114 (51%)
In this facility, we listen to what community members think about the healthcare services we provide for HTN	3.7	4.0	30 (14%)	41 (18%)	152 (68%)
In this facility, we have meetings with community members to discuss health matters regarding HTN	3.6	4.0	30 (14%)	48 (22%)	145 (65%)
In this facility, we encourage community members to contribute to improving HTN in the community	3.7	4.0	29 (13%)	33 (15%)	161 (72%)
In this facility, we encourage other organizations to contribute to improving HTN in the community	3.3	3.0	44 (20%)	81 (36%)	98 (44%)
Monitoring services for action	3.2	3.2	-	-	-
I receive regular updates about the facility's performance on HTN based on information/data collected from our facility	2.7	3.0	110 (49%)	51 (23%)	62 (28%)
This facility discusses information/data from our facility on HTN in a regular, formal way, such as in regularly scheduled meetings	3.2	3.0	60 (27%)	73 (33%)	90 (41%)
This facility regularly uses facility information/data to make plans for improving its healthcare services for HTN	3.1	3.0	41 (18%)	108 (48%)	74 (33%)
This facility regularly monitors its work by comparing it with the facility's action plans for HTN	3.2	3.0	30 (14%)	117 (53%)	76 (34%)
This facility regularly compares its work with national or other guidelines for HTN	3.6	4.0	19 (9%)	68 (31%)	136 (61%)
Commitment to work	4.2	4.3	-	-	-
I am proud to work in this facility	4.0	4.0	16 (7%)	24 (11%)	183 (82%)
I am satisfied to work in this facility	3.9	4.0	24 (11%)	23 (10%)	176 (79%)
I feel encouraged to do my very best at work	4.6	5.0	6 (3%)	8 (4%)	209 (94%)
Work culture	4.1	4.2	-	-	-
Culture of learning and change	3.8	3.7	-	-	-
This facility is willing to use new healthcare practices such as guidelines and recommendations for HTN	3.9	4.0	8 (4%)	45 (20%)	170 (76%)
This facility helps me to improve and develop my skills in HTN	3.1	3.0	87 (39%)	37 (17%)	99 (44%)
I am encouraged to seek new information on healthcare practices for HTN	4.4	4.0	7 (3%)	13 (6%)	203 (91%)
Culture of responsibility	4.1	4.0	-	-	-

This facility works for the good of the clients and puts their needs first in treatment of HTN	3.8	4.0	17 (8%)	51 (23%)	155 (70%)
Members of the facility feel personally responsible for improving healthcare services for HTN	4.2	4.0	3 (1%)	34 (15%)	186 (83%)
Members of the facility approach clients with HTN with respect	4.4	4.0	3 (1%)	10 (5%)	210 (94%)
Leadership	4.1	4.0	-	-	-
I trust the facility leader	4.2	4.0	9 (4%)	11 (5%)	203 (91%)
The leader handles stressful situations calmly	4.0	4.0	13 (6%)	26 (12%)	184 (83%)
The leader actively listens, acknowledges, and then responds to requests and concerns	4.0	4.0	14 (6%)	22 (10%)	187 (84%)
The leader effectively resolves any conflicts that arise	4.1	4.0	9 (4%)	16 (7%)	198 (89%)
The leader encourages the introduction of new ideas and practices	4.2	4.0	6 (3%)	13 (6%)	204 (92%)
The leader makes things happen	4.0	4.0	11 (5%)	32 (14%)	180 (81%)
Informal payment	4.7	4.8	-	-	-
Informal payment	4.7	5.0	-	-	-
Clients must always give informal payment to health workers to access healthcare services for HTN	4.9	5.0	1 (0.4%)	3 (1%)	219 (98%)
Clients are treated more quickly if they make informal payments to health workers for HTN	4.9	5.0	3 (1%)	5 (2%)	215 (96%)
Medicines or equipment for HTN that should be available for free to clients have been sold in this facility	4.6	5.0	5 (2%)	24 (11%)	194 (87%)
Health workers are sometimes absent from work earning money at other places	4.5	5.0	5 (2%)	34 (15%)	184 (83%)
Nepotism	4.6	5.0	-	-	-
Health workers in this facility give healthcare services for HTN to friends and family first	4.7	5.0	4 (2%)	10 (5%)	209 (94%)
Health workers in this facility give jobs or other benefits to friends and family first	4.5	5.0	10 (5%)	28 (13%)	185 (83%)
Accountability	2.8	3.0	-	-	-
Efforts are made to stop clients from providing informal payment to get appropriate healthcare services in HTN	2.8	3.0	99 (44%)	49 (22%)	75 (34%)
Efforts are made to stop health workers from asking clients for informal payment for HTN	2.8	3.0	97 (44%)	40 (18%)	86 (39%)

Non-scaled dimension/items	Mean	Median	NA, never, rarely	Occasionally	Frequently, always
Sources of Knowledge	0.6	0.6	-	-	-
Clinical practice guidelines for HTN	0.7	1.0	52 (23%)	35 (16%)	136 (61%)
Other printed material for work (e.g. textbooks, journals) with HTN	0.6	1.0	58 (26%)	45 (20%)	120 (54%)
In-service training/ workshops/courses for HTN	0.5	0.5	102 (46%)	41 (18%)	80 (36%)
The Internet for HTN	0.6	0.5	65 (29%)	47 (21%)	111 (50%)
Electronic decision support (e.g. mobile phone applications or other electronic devices to assist with care and decision-making) for HTN	0.5	0.5	105 (47%)	28 (13%)	90 (40%)

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	4-5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5-6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7-8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6-8
Bias	9	Describe any efforts to address potential sources of bias	5
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7-8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7-8
		(*b*) Describe any methods used to examine subgroups and interactions	7-8
		(*c*) Explain how missing data were addressed	7-8
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	n/a
		(*e*) Describe any sensitivity analyses	n/a
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	n/a
		(c) Consider use of a flow diagram	n/a
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8-9
		(b) Indicate number of participants with missing data for each variable of interest	n/a
Outcome data	15*	Report numbers of outcome events or summary measures	9-11
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	

		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	9-11
Discussion			
Key results	18	Summarise key results with reference to study objectives	11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13
Generalisability	21	Discuss the generalisability (external validity) of the study results	11-13
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.