3-2019

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A 12-Month Prospective Evaluation of Program Impact on Health Care Providers' Knowledge and Treatment of Hypertension

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ABSTRACT

Background: Given the rising burden of hypertension in Africa, the Healthy Heart Africa program was developed to improve access to quality hypertension care in the primary care setting. The Healthy Heart Africa program provides a comprehensive, coordinated intervention directed at health care providers (HCPs) and the general public.

Objective: The impact of Healthy Heart Africa on HCPs' knowledge of hypertension and facility-level services in Kenya was evaluated by a 12-month prospective study.

Methods: Intervention facilities were selected by stratified random sampling and matched to similar control facilities. Intervention facilities received a hypertension treatment protocol, equipment, training and patient education materials, and improved medical supply chain, whereas control facilities did not. HCPs responsible for hypertension care were surveyed at baseline and 12 months later. Hypertension screening and treatment data were abstracted from service delivery registers. A differences-in-differences analysis estimated the impact of Healthy Heart Africa on HCPs' knowledge, hypertension services, and the number of patients diagnosed with and seeking treatment for hypertension.

Results: Sixty-six intervention and 66 control facilities were surveyed. Healthy Heart Africa improved HCPs' knowledge of ≥5 hypertension risk factors and ≥5 methods for reducing/managing hypertension but not hypertension consequences. At end line, more intervention than control facilities measured blood pressure more than once during the same visit to diagnose hypertension, dedicated days to hypertension care, used posters to increase hypertension awareness, and provided access to hypertension medications. The number of patients diagnosed with hypertension and those seeking treatment for hypertension increased with intervention, but the change was not significant relative to control subjects.

Conclusions: HCP-directed hypertension education and provision of basic resources positively influenced hypertension care in Kenya in the first 12 months of implementation.

The growing burden of noncommunicable diseases, including cardiovascular disease (CVD), is a major global health problem. CVD is a leading cause of death worldwide [1]. Hypertension alone, a major risk factor for CVD, is responsible for approximately 9.4 million deaths annually [2]. To combat the growing burden of CVD and hypertension, health care systems must be adequately educated and equipped to provide preventative care and treatment options. Developing countries, which often have poor health care infrastructure, face a double burden of disease, as the rising rates of CVD and other noncommunicable diseases occur along with existing communicable diseases (e.g., human immunodeficiency virus, malaria, and tuberculosis).

Kenya is one such country facing a growing prevalence of CVD and hypertension. In Kenya, prevalence estimates of hypertension range from 12.3% to 22.8% and CVD-associated mortality from 6.1% to 8.0% [3-6]. Not surprisingly, the high rates of hypertension and CVD are observed in parallel with high prevalence rates of risk factors for hypertension, including alcohol and tobacco use and poor diet [7,8]. To further exacerbate the burden, the overall awareness and control rate for hypertension remain low [3,5,9]. The 2015 Kenya STEPwise survey found that 56% of Kenyans never had their blood pressure (BP) tested. Among those diagnosed with hypertension, only 22.3% were currently taking prescribed medication [5].

Multiple barriers exist to achieving adequate control of hypertension in Kenya. Lack of confidence in health care facilities because of various factors, including poor quality of services, limited access to low-cost medications, and

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GLOBAL HEART

VOL. 14, NO. 1, 2019
ISSN 2211-8160/$36.00.
https://doi.org/10.1016/j.gheart.2019.02.002

lack of functioning equipment, contribute to low utilization and may affect hypertension control efforts [10-12]. Furthermore, anecdotal information suggests that diagnosis may occur after complications have developed, and more severe illness puts additional pressure on secondary health care systems. Providing greater access to BP screening and hypertension services at the primary level may improve the timely detection of elevated BP, hypertension diagnosis, preventative care efforts, and associated clinical outcomes.

Healthy Heart Africa (HHA) is an AstraZeneca-sponsored program designed to improve access to quality hypertension control in a primary care setting. Through public-private collaborations, the HHA program aimed to increase hypertension awareness and education among health care providers (HCPs) and the general public; to improve HCPs' knowledge and skills for hypertension screening and treatment; to create a protocol for hypertension care; and to increase access to affordable hypertension medications. Here, we report results from a 12-month prospective, controlled pilot study in Kenya that evaluated the change in HCPs' knowledge of hypertension and facility-level hypertension screening and treatment over the time of the HHA program.

MATERIALS AND METHODS

Overview of HHA in Kenya

The HHA program was initiated in March 2015 across 21 counties in Kenya, including Nairobi and the surrounding areas and parts of Western Kenya (Online Fig. 1). HHA partnered with an independent group of experts from professional medical organizations (the Kenya Association of Physicians, the Kenya Cardiac Society, and the Kenya Renal Association) and academia to develop a uniform protocol for screening and diagnosing hypertension, which was endorsed by the Kenyan Ministry of Health before implementation. The protocol includes a treatment algorithm for hypertension and guidance regarding routine evaluation (including BP measurement), potential drug interactions, indications for immediate referrals, and healthy lifestyle modifications (see Online Material 1 in the Online Appendix, which describes the hypertension treatment protocol).

HHA collaborated with 5 implementing partners (Academic Model Providing Access to Healthcare, African Medical and Research Foundation, Christian Health Association of Kenya, Jhpiego, and Population Services Kenya) to integrate hypertension education and care into primary health and outreach services provided at public, private, and faith-based facilities. Each implementing partner developed unique methods for increasing hypertension awareness, education, and screening within the community and among HCPs. A Kenyan pharmaceutical distributor, the Mission for Essential Drugs and Supplies, ensured that participating intervention facilities had free access to AstraZeneca's comprehensive hypertension medications.

Study design

The effect of HHA intervention on Kenyan HCPs' knowledge and practices of hypertension and facility-level hypertension screening and treatment was evaluated as part of a 12-month prospective analysis. Each implementation partner provided a list of supported facilities from which 75 HHA intervention facilities were identified using a randomized, multilevel clustered sampling approach. Each selected intervention facility was then matched to a similar control facility based on the implementing partner, county, and facility type (e.g., district/subdistrict hospital, health center, or dispensary/clinic). If these criteria could not be satisfied, intervention facilities were matched to control facilities from a neighboring county.

At program inception (in February 2015), a broad range of trainers of trainers, including medical officers, diploma clinicians (physician assistants), and nurses, from the implementation partners were centrally trained by a physician (a consultant for HHA). The trainers of trainers from each implementation partner then trained HCPs centrally within their region. Toward the end of the first year, intervention facilities, in particular those serving a high volume of individuals, received additional training from trainers of trainers. Participating intervention facilities also received equipment (e.g., BP machines), training materials, the HHA hypertension protocol, and educational materials (e.g., posters and brochures). Intervention facilities could also procure HHA-recommended medications through Mission for Essential Drugs and Supplies. HCPs received additional training from the HHA/AstraZeneca Key Accounts team to ensure that these medications were properly prescribed. In this study, all health care facilities assigned intervention received HHA program intervention within 7 to 8 months following the baseline survey. Control facilities and associated HCPs did not receive these interventions.

To assess the effect of the HHA program, a facility questionnaire was developed and pilot tested by Abt Associates before fielding. Data collectors from Ipsos Synovate Kenya (trained by Abt Associates and/or Ipsos project leaders) administered the survey. Data were collected using personal digital assistant phones.

The survey (see Online Material 2 in the Online Appendix, which shows the facility questionnaire) was administered shortly before the HHA program began in February 2015 (referred to as baseline) and approximately 12 months later in March 2016 (referred to as end line). At each participating facility, the survey was completed by the facility manager and the HCP most likely to provide services related to hypertension diagnosis, care, and treatment. The facility manager was questioned regarding staffing, availability of equipment and supplies, and hypertension screening data (based on medical records), whereas the

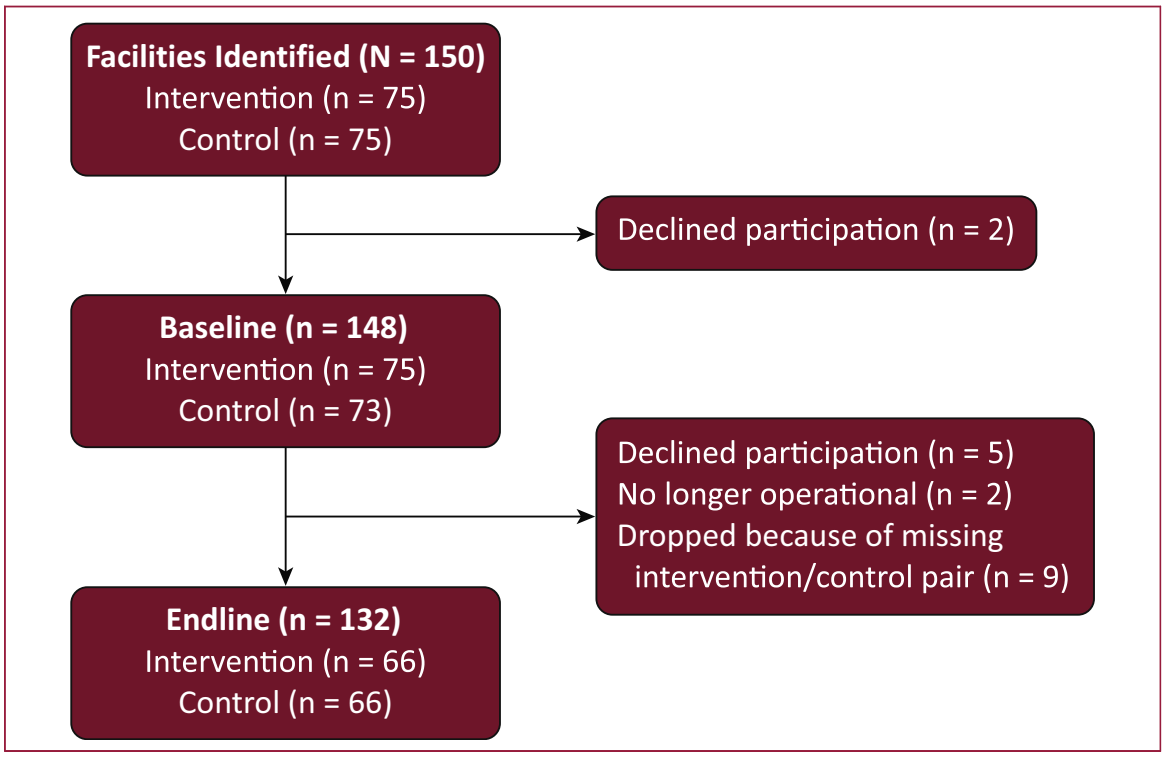

FIGURE 1. Facility attrition.

HCPs were asked 17 questions pertaining to their knowledge of hypertension (i.e., diagnosis, risk factors, consequences, and treatment) and hypertension-related services provided at the facility. The availability of hypertension medication was recorded following visual confirmation or, if not directly checked, based on facility manager report. Data for the following outcomes were abstracted from service delivery registers: available medications, number of adult patients with hypertension seen at the facility within the previous 3 months that either had hypertension or were newly diagnosed with hypertension, and those who visited the facility $\geq$1 time per month to check BP or receive hypertension medication. BP screening and hypertension diagnosis/treatment data (referred to as monitoring data) were collected from participating intervention facilities and as part of outreach BP screening campaigns conducted at homes (door-to-door) and local gatherings (e.g., churches and workplaces). Data collection at intervention facilities was initiated after the completion of HCP training.

This study was reviewed and approved first by the Abt Associates Internal Review Board, then by the Kenyatta National Hospital and the University of Nairobi Ethics and Research Committee (KNH/UON-ERC). Written informed consent was obtained from all survey respondents prior to completing the survey.

Statistical analysis

A differences-in-differences regression analysis was used to assess treatment effect. By comparing the change in outcomes over time among intervention facilities to that of matched control facilities, the differences-in-differences analysis minimized bias due to other factors that change over the same time frame, allowing the effect of the HHA intervention to be identified. Individual intervention facilities were matched to individual control facilities based on implementation partner, facility type (hospital, health center, or dispensary/clinic), and county (taking care not to match facilities that were too close in proximity to minimize or avoid potential overlap in patient populations). Perfect matches on all three dimensions were not always possible. The analysis also controlled for urban versus rural setting, facility medical staffing (the presence of a doctor, a clinical officer, and/or a Kenyan registered nurse), facility resources (e.g., working electricity and piped water), and, for control facilities, the distance to its paired intervention facility. The final analysis excluded facilities that had closed or those unwilling to participate at end line. To maintain balance between the treatment groups, any matched pair in which one facility fell out of the sample or switched treatment (e.g., the control facility received the intervention, or the intervention facility did not) was excluded unless the facilities could be matched with a different facility pair that had the same characteristics (with weights updated accordingly).

At baseline, balance between the intervention and control groups was determined using a *t* test for bimodal variables and a chi-square test for outcomes with more than 2 possible values. Analysis conditioning, using the thresholds

of ≥3 and ≥5, was used to evaluate improvement in HCPs' knowledge of hypertension risk factors and consequences and methods for managing hypertension. The differences-in-differences regressions were conducted using weighted least squares. No adjustments were made for multiplicity.

RESULTS

Facilities characteristics and staffing

Of the 150 facilities originally planned for this analysis, 18 (9 from each arm) were excluded because of facility closure, missing intervention/control pair, or unwillingness to participate at end line (Fig. 1). The final analysis included 66 intervention and 66 control facilities, consisting of dispensaries/clinics, health centers, and district/subdistrict hospitals, that were sampled in this analysis (Table 1, Online Fig. 1). Most health care sites were public-sector facilities, followed by private-sector and faith-based organization facilities. At baseline, intervention and control facilities did not differ substantially. A significantly greater proportion of intervention facilities had access to electricity and piped water ($p < 0.05$ for both); however, access to basic health care equipment, including BP machines, did not differ significantly between groups (Table 1). At baseline, staff composition was fairly similar at intervention and control facilities. However, after 12 months, both groups reported a significant increase in registered nurses and clinical officers ($p < 0.01$) (see Online Table 1, which displays the staffing of facilities).

TABLE 1. Facility characteristics at baseline

Facility Characteristics, %	Intervention (n = 66)	Control (n = 66)	p Value
Sector			0.998
Public	44.6	45.1	
Private	36.2	35.7	
Faith-based	19.2	19.2	
Health care level			0.373
Dispensary/clinic	55.9	67.2	
Health center	24.0	20.8	
District/subdistrict hospital	20.1	12.1	
Facility location			0.328
Urban	46.5	36.6	
Rural	53.5	63.4	
Infrastructure			
Electricity	96.3	85.8	0.041
Piped water	88.5	68.7	0.008
Equipment			
Stethoscope	96.9	97.2	0.932
Blood pressure machine	99.2	93.3	0.093
Adult weighing scale	95.2	92.7	0.558
Thermometer	98.8	94.7	0.200
Measuring tape	84.8	81.2	0.613
Stadiometer	27.4	30.8	0.690
Provider type			
Physician	9.6	7.7	0.706
Medical officer	13.7	15.8	0.768
Clinical officer	32.2	35.9	0.693
Degree nurse	15.8	10.3	0.365
Registered nurse	61.8	44.0	0.071
Registered midwife	34.2	20.5	0.117
Enrolled nurse	55.3	41.7	0.165
Nurse attendant	20.0	12.4	0.312

HCPs' knowledge of hypertension

Over 12 months, the HHA program improved HCPs' knowledge of risk factors for hypertension and methods for reducing or managing hypertension (Table 2; Online Table 2). A significantly greater proportion of HCPs from intervention versus control facilities identified tobacco use ($p < 0.01$) and alcohol consumption ($p < 0.05$) as risk factors for hypertension (Table 2). The proportion of HCPs who identified at least 5 risk factors for hypertension increased significantly at intervention facilities, an estimated treatment effect of 21.2 percentage points (pp) ($p < 0.05$) (Table 2). The proportion of HCPs who recommended dietary changes to manage or reduce hypertension increased by 25.6 pp ($p < 0.05$) at intervention facilities (Table 2). The proportion of HCPs from intervention facilities who identified at least 5 methods for reducing or managing hypertension increased by 43.6 pp ($p < 0.05$) (Table 2). At both intervention and control facilities, the proportion of HCPs who identified the correct BP thresholds increased from baseline to end line (Table 2). The HHA program did not have a positive effect on HCP's knowledge of hypertension consequences (Table 2).

Hypertension services

At end line, a greater proportion of intervention versus control facilities was likely to repeat BP measurements at the same visit to diagnose hypertension (estimated treatment effect, 29.3 pp; $p < 0.05$), have days dedicated to hypertension care (22.5 pp; $p < 0.05$), and display posters to increase awareness of hypertension (49.3 pp; $p < 0.01$) and BP thresholds (28.0 pp; $p < 0.01$) (Table 3). The availability of hypertension medications improved at intervention facilities, with availability of guideline-recommended drugs such as hydrochlorothiazide and amlodipine increasing by 25.4 pp ($p < 0.05$) and 17.0 pp (p = not significant), respectively, relative to control facilities, whereas availability of β-blockers or methyldopa (not guideline-recommended drugs) remained mostly unchanged (Table 3). The number of new patients with hypertension within the last 3 months and those seeking treatment (returning to the facility for BP checks and/or to receive medication) numerically increased at both intervention and control facilities (Fig. 2; Online Table 3). Monitoring data (captured by implementing partners, not the facility survey) demonstrated an increasing trend in the number of patients screened, diagnosed, and treated for hypertension (Fig. 3).

TABLE 2. HCPs' knowledge of HTN-related risk factors and consequences, BP thresholds, and methods for reducing HTN

	Baseline		End Line		
	Intervention (n = 66)	Control (n = 66)	Intervention (n = 66)	Control (n = 66)	Treatment Effect (SE), Percentage Points
HCPs who identified, %					
≥3 HTN risk factors	38.5	54.0	68.6	69.6	16.8 (12.7)
≥5 HTN risk factors	9.7	6.1	30.7	7.9	21.2 (9.4)*
≥3 medically known consequences of HTN	79.5	76.6	59.7	68.8	−9.3 (12.9)
≥5 medically known consequences of HTN	24.2	23.8	14.4	19.2	−4.4 (11.0)
≥3 medically known methods for reducing/managing HTN	66.7	67.7	80.9	81.8	−0.1 (11.7)
≥5 medically known methods for reducing/managing HTN	15.4	33.0	49.8	27.1	43.6 (11.2)*
Systolic and diastolic thresholds for high BP	49.7	38.6	87.7	91.1	−12.3 (10.2)
Systolic and diastolic thresholds for severe high BP	12.4	8.9	74.2	66.5	7.2 (10.1)
HCPs who identified risk factors of HTN, %					
Age	30.8	24.5	34.2	37.0	−6.7 (12.0)
Family history	62.9	59.9	69.7	64.0	0.2 (12.4)
High BMI/obesity/overweight	39.1	42.5	80.1	67.8	15.1 (11.3)
High salt intake	37.1	36.7	36.8	48.1	−10.4 (13.1)
Use of tobacco products	33.9	34.6	58.1	26.8	34.4 (12.6)†
High alcohol consumption	21.3	39.1	48.1	37.5	30.4 (12.7)*
Lack of physical activity	41.7	41.8	27.3	35.5	−9.1 (12.7)
HCPs who identified consequences of HTN, %					
Death	41.6	50.3	41.0	54.0	−0.1 (12.2)
Heart attack	52.8	47.3	45.8	49.4	−5.0 (13.4)
Stroke	88.3	77.4	87.8	90.4	−10.9 (9.2)
Aneurysm	16.1	17.0	15.5	15.3	0.7 (9.0)
Heart failure	67.6	44.3	47.6	67.3	−43.0 (14.1)†
Loss of sight	38.2	38.5	43.2	21.7	22.0 (11.9)
Renal disease	42.7	39.6	4.5	7.3	−6.3 (12.8)
HCPs who identified methods for reducing/managing HTN, %					
Reduce salt	43.3	47.5	51.1	47.7	6.7 (13.4)
Weight loss	32.2	45.8	44.0	56.4	−9.4 (9.9)
Medication	54.3	74.5	54.5	61.7	12.6 (13.8)
Exercise	79.3	68.7	80.0	68.5	3.1 (12.2)
Dietary changes	48.6	49.9	69.8	49.6	25.6 (12.8)*
Reduce alcohol	35.1	33.9	56.9	36.0	22.8 (12.5)
Stop smoking	33.9	25.3	54.8	32.3	16.5 (12.4)

BMI, body mass index; BP, blood pressure; HCP, health care provider; HTN, hypertension; SE, standard error.

*$p < 0.05$.

†$p < 0.01$ vs. Intervention and Control facilities.

TABLE 3. Hypertension services offered

	Baseline		End Line		
	Intervention (n = 66)	Control (n = 66)	Intervention (n = 66)	Control (n = 66)	Treatment Effect (SE), Percentage Points
HCPs who measured, %					
BP every visit	88.6	86.9	98.0	90.0	5.3 (7.5)
BP >1 time to diagnose HTN	71.0	79.5	84.7	65.0	29.3 (12.0)*
Facilities with, %					
Dedicated days to HTN care	28.8	14.8	54.4	15.1	22.5 (10.4)*
Displayed educational HTN posters	10.8	3.0	79.5	19.7	49.3 (9.3)†
Displayed BP threshold	6.2	5.3	44.2	13.4	28.0 (9.2)†
Available medications,‡ %					
Thiazides					
Hydrochlorothiazide	46.3	51.6	64.3	45.6	25.4 (11.2)*
Calcium channel blockers					
Amlodipine	26.7	15.5	44.9	15.0	17.0 (9.7)
Nifedipine	65.0	52.8	73.3	51.6	11.1 (12.0)
β-blockers					
Propranolol	32.9	9.0	29.7	13.4	−4.3 (7.8)
ACE inhibitors					
Enalapril	47.1	32.6	56.3	27.9	15.0 (10.3)
Centrally acting drugs					
Methyldopa	38.4	29.3	38.5	28.9	1.7 (10.3)

ACE, angiotensin-converting enzyme; ARB, angiotensin receptor blocker; other abbreviations as in Table 2.

*$p < 0.05$.

†$p < 0.01$ vs. Intervention and Control facilities.

‡Availability of medication defined based on visual confirmation that the facility had the medication in stock.

DISCUSSION

This assessment of the HHA program provided data on the status of hypertension care in Kenya, identified areas for potential improvement, and provided a systematic review of changes in these parameters over the 12-month study period. Before implementation of the HHA program in Kenya, hypertension treatment and control—especially in primary health care facilities—were poor, with rates as low as 9% and 3%, respectively [9]. Indeed, baseline data from this study suggest that HCPs' knowledge of high and severely high BP thresholds, hypertension-associated risk factors, consequences, and services, including access to medication, was poor among the participating facilities, presumably because of low rates of hypertension screening and treatment at primary care facilities. After 12 months of implementation, early evidence demonstrated the positive impact of the HHA program in addressing some of these barriers to hypertension care.

The interventions implemented as part of the HHA program increased the emphasis on hypertension preventative care, screening, diagnosis, and treatment at participating facilities. The observed increase in the identification of influential risk factors for hypertension by HCPs supports the effectiveness of this approach. An increase in the proportion of HCPs able to identify dietary changes, reduction of alcohol use, and cessation of smoking as methods for reducing hypertension was also observed from the beginning to the end of the study period. This may lead to increased patient education and, in turn, to adoption of positive lifestyle modifications. Moderation of alcohol intake and improvements in nutrition (increased consumption of fruit and vegetables; reduced fat and sodium intake) can reduce systolic BP by ∼2 to 4 mm Hg and ∼2 to 14 mm Hg, respectively [13].

More frequent BP monitoring and greater understanding of the measured values were also documented. HCPs were observed to measure BP more than once in the same visit at intervention facilities, an activity that is expected to result in more accurate diagnosis of high BP among Kenyans. A marked increase in the proportion of HCPs who accurately provided correct systolic and diastolic BP thresholds was observed at both intervention and control facilities. However, because the change from baseline to end line was greater for the control (from 38.6% to 91.1%) versus intervention (from 49.7% to 87.7%) facilities, the HHA program did not appear to have a positive effect. The observed increase among the control facilities was unexpected and may be attributed to a scale-up of activities that were launched in response to the national and global initiatives to improve noncommunicable disease control [5,14]. Even though it is assumed that HCPs received previous training in hypertension care, the current data indicate

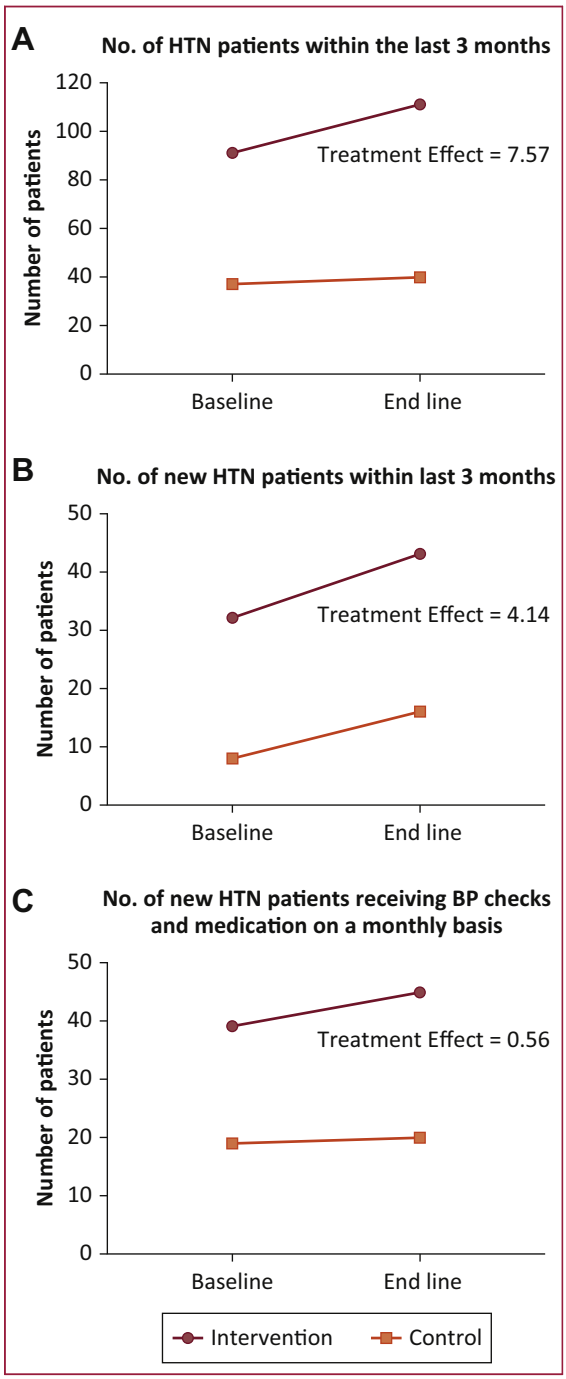

FIGURE 2. Differences-in-differences graphs describing the impact of Healthy Heart Africa on the number of hypertension (HTN) cases. (A) No. of HTN patients within the last 3 months; (B) Number of new HTN patients within the last 3 months; (C) Number of new HTN patients receiving BP checks and medication on a monthly basis.

the need for continuous reinforcement, through further medical training (including program retraining) and clinical practices, to motivate HCPs to engage in hypertension care on a more regular basis. The indication of activities for noncommunicable diseases (including hypertension) control supports the growing interest in hypertension care in Kenya and further demonstrates that these HCPs are receptive to improvements in their practices and striving to provide better patient care.

Although this 12-month pilot study demonstrates the positive impact of the HHA program on HCPs' knowledge of hypertension and standard of care, there is room for further improvement. Because the HHA-developed protocol did not stress the consequences of untreated hypertension, the HHA program did not affect HCPs' knowledge of hypertension-related consequences over the 12-month observation period. Although it is possible that an improvement in knowledge may be observed over a longer period of time, these data demonstrate that specific education on hypertension-related consequences should be included in the HHA program, as this knowledge provides the rationale for screening, diagnosing, and treating hypertension for both HCPs and community members.

The HHA program had a positive impact on the availability of hypertension medications, particularly thiazides and calcium channel blockers, which were emphasized in the HHA hypertension protocol. In particular, availability of hydrochlorothiazide and amlodipine increased after the 12-month period. Although this evaluation did not study the facilities' access to medications in great detail, the lack of significant improvement in access to protocol-recommended medications among intervention facilities may be attributed to the differences in procurement processes between implementing partners and among public versus private health care facilities. During the first year of the HHA program, no increase was noted in the average number of patients diagnosed with hypertension or the number of patients returning for care. Because the facility survey did not capture the number of patients screened for hypertension, several scenarios are possible. Screening rates may have been low, or the patients screened may have been healthy or sought care elsewhere if they were hypertensive. Alternatively, increases in hypertension diagnosis and adherence to hypertension care may be long-term outcomes and not achievable by an educational program in 1 year. Nonetheless, the monitoring data demonstrated a trend toward increased screening, diagnosis, and treatment for hypertension, indicating that continuing the program may result in clear benefits over time.

Similar studies have shown that improving HCP education can translate into improvements in BP control over time. Training rural Vietnamese health care workers in proper hypertension management led to a significant reduction in systolic and diastolic BP among 459 patients within 17 months [11]. Similarly, a 10-month program that focused on training pharmacists in Nigeria to take patients' BP and counsel 40 hypertensive patients led to a decrease in average systolic and diastolic BP and improvement in healthy lifestyle activities, such as reducing salt intake, alcohol moderation, and exercise [12].

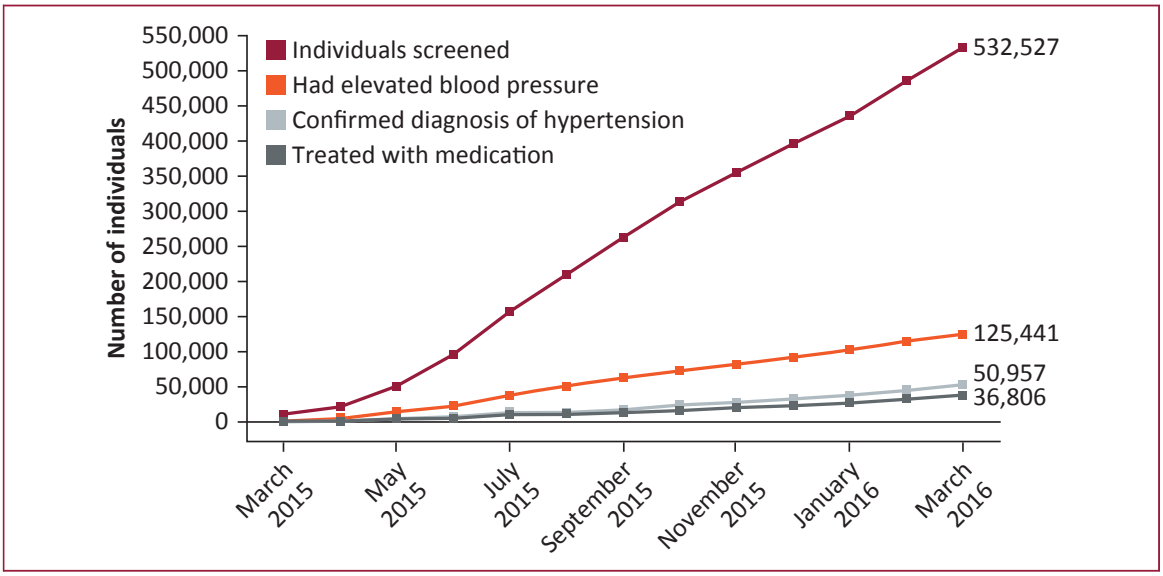

FIGURE 3. Change in patient pathway over time at participating Healthy Heart Africa intervention facilities. Cumulative data are reported.

The Kenyan health care system is continuously evolving because of the recent devolution of Kenya's centralized governing system into 47 county governments [13]. Whereas general improvements in hypertension care, such as implementation of other training programs, are positive for the community, capturing the full impact of the HHA program can be challenging. In particular, program evaluation may be impacted by the movement of medical personnel, a by-product of the devolution, which occurred across public facilities at the time of the study. The potential exchange of HHA-trained HCPs for those from control or nonparticipating facilities may contribute to either a reduction or no change in knowledge with intervention, as reflected by the lack of improvement in key parameters, such as HCPs' knowledge of high salt intake as a hypertension risk factor and the use of medications for the management of hypertension. This, in turn, may result in smaller differences in knowledge between the treatment groups and an underestimation of program impact. However, a major strength of the current analysis was the use of the differences-in-differences approach, which allows for changes in underlying conditions over time when evaluating the impact of the HHA program. Thus, this analysis provided a high-quality snapshot of the positive impact of HHA on hypertension care in Kenya during its first 12 months of implementation, despite changes in the Kenyan health care system implemented during the study period.

Within 12 months of implementation, HHA was shown to have an initial positive impact on HCP knowledge. However, the evaluation period was not sufficient to realize the full impact of the program on the hypertension care and services provided by both HCPs and facilities. Significant changes in both behavior (e.g., HCPs' knowledge and care) and at the system level (e.g., facilities services and access to medications) are expected to occur gradually over a prolonged period of time, typically several years. Thus, a longer program evaluation period (>12 months) is needed to identify key program attributes that contribute to and/or are obstacles to achieving significant improvement in long-term hypertension care.

This analysis has additional limitations. The distribution of amenities (e.g., piped water and electricity) and medical personnel (e.g., the proportion of clinical officers or registered nurses) was not equal between intervention and control facilities because it was not possible to match all intervention facilities with a perfectly comparable control facility. In particular, implementation facilities tended to be in urban areas, which likely explains the differences in amenities and staffing. However, matching facilities based on key characteristics reduced the potential for bias. The modest sample size limits the ability to make any comparisons based on geographic location and facility sectors. At times, HCPs may have misunderstood survey questions, possibly resulting in the decreased responses to certain questions over time. To minimize this possibility, the survey questions were tested before fielding and administered by medically trained personnel. Because the primary focus of this pilot study was to evaluate the initial impact of the HHA program on HCP's knowledge of hypertension, the study did not investigate in great detail facility readiness (e.g., human resources, BP machines [type, validity, and functionality], and procurement of essential medicines) as well as the quality of the intervention materials provided, including HCP training, as compared with the World Health Organization tools, such as the Service Availability and Readiness Assessment and Package of Essential Noncommunicable Disease

Interventions for primary health care in low-resource settings [15,16]. Future evaluations of the HHA program will utilize such tools to ensure that HCPs have the resources and adequate training needed to provide high-quality care and capture information regarding procurement of key medications and training provided to HCPs.

CONCLUSIONS

Overall, the HHA program positively affected HCPs' knowledge and practice of hypertension care at 12 months and supported the public-private partnership approach to expand access to care across a diverse population, differentiated by health care sources. Through collaboration with the Kenyan Ministry of Health and leading implementation partners, HHA was able to utilize the existing health care infrastructure to expand the outreach of HHA for providing improved care for people in Kenya. HHA improved HCP training and the quality of hypertension services by integrating hypertension services into primary and community health care systems, which largely focus on maternal/child health, human immunodeficiency virus, and malaria. The HHA program contributes to the Kenyan government's ongoing efforts to achieve the World Health Organization's goal of reducing the prevalence of raised BP by 25% by 2025 and is also in line with the World Heart Federation and the Pan-African Society of Cardiology roadmaps for achieving hypertension control [14].

The development and dissemination of uniform hypertension management protocols, efficient supply and distribution of hypertension medications, and other initiatives to improve hypertension care in primary care settings are important throughout the region. Future scale-up efforts across Kenya, Ethiopia, and sub-Saharan Africa will focus on developing effective strategies for improving hypertension detection/diagnosis, HCP knowledge and treatment practices, and access to essential medications. The lessons learned from HHA will help to inform ongoing efforts to improve hypertension care in primary health care settings and the development of health care policy and infrastructure across Africa. Through new collaborative partnerships, the HHA program hopes to expand access to and uptake of care for chronic conditions in under-resourced settings.

ACKNOWLEDGMENTS

The authors would like to thank all of the individuals involved in data collection, field monitoring, and data analysis for this study. The authors also thank Academic Model Providing Access to Healthcare, African Medical and Research Foundation, Christian Health Association of Kenya, Jhpiego, and Population Services Kenya for their cooperation in sampling, survey feedback, and overall help with the study. The authors acknowledge Drs. David Webb, Mark Joshi, Charles Kariuki, C. Muyodi, Mohammed S. Abdallah, Feroz Alibhoy, James Jowi, Bernard Gitura, Constantine Akwanalo, Rochester Shen, Adam Lambert, Erika Koppers, and Samer al Halaq for their assistance with the development of the hypertension protocol that was used in the HHA program. From the Kenyan Ministry of Health, the authors thank Dr. Nicholas Muraguri, Principal Secretary of Medical Services, and Dr. Joseph Kibachio, Head of the Division of Noncommunicable Disease, for their approval and support of this study. The authors also thank Alec van Gelder, Javier Jimenez, Clive Pickering, Ian MacTavish, Allan Mackenzie, and Kennedy Njau from AstraZeneca for their support of the HHA program and this study. The authors thank Doug Johnson, previously of Abt Associates, for contributing to the design strategy for this evaluation. The authors thank Mary Beth DeYoung of AstraZeneca for providing a critical review of the manuscript. Disha Patel, PhD, CMPP, of inScience Communications, Springer Healthcare (Philadelphia, PA, USA), provided medical writing support, which was funded by AstraZeneca.

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