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Costs of Integrating Hypertension Care into HIV Care in Rural East African Clinics

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Abstract

Objective: Sub-Saharan Africa faces twin epidemics of HIV and non-communicable diseases including hypertension. Integrating hypertension care into chronic HIV care is a global priority, but cost estimates are lacking. In the SEARCH Study, we performed population-level HIV/hypertension testing, and offered integrated streamlined chronic care. Here, we estimate costs for integrated hypertension/HIV care for HIV-positive individuals, and costs for hypertension care for HIV-negative individuals in the same clinics.

Design: Microcosting analysis of healthcare expenditures within Ugandan HIV clinics.

Methods: SEARCH (NCT:01864603) conducted community health campaigns for diagnosis and linkage to care for both HIV and hypertension. HIV-positive patients received hypertension/HIV care jointly including blood pressure monitoring and medications; HIV-negative patients received hypertension care at the same clinics. Within 10 Ugandan study communities during 2015–2016, we estimated incremental annual per-patient hypertension care costs using micro-costing techniques, time-and-motion personnel studies, and administrative/clinical records review.

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AUTHOR CONTRIBUTIONS:

SBS, TO, DK, LBB, MLP, MRK, DVH, and VJ contributed to design of hypertension costing analysis. BM, RM, EK, FM, JK, and AO contributed to data collection. SBS, TO, DK, LBB, AL, BM, RM, EK, HI, MLP, MRK, DVH, and VJ contributed to data analysis. All authors contributed to data interpretation. SBS and VJ drafted manuscript, and all authors contributed to manuscript revision.

DISCLOSURES/CONFLICTS OF INTEREST:

Related to work in this manuscript, all authors declare no conflicts of interests.

Results: Overall, 70 HIV-positive and 2355 HIV-negative participants received hypertension care. For HIV-positive participants, average incremental cost of hypertension care was \$6.29/person/year, a 2.1% marginal increase over prior estimates for HIV care alone. For HIV-negative participants, hypertension care cost \$11.39/person/year, a 3.8% marginal increase over HIV care costs. Key costs for HIV-positive patients included hypertension medications (\$6.19/patient/year;98% of total) and laboratory testing (\$0.10/patient/year;2%). Key costs for HIV-negative patients included medications (\$5.09/patient/year;45%) and clinic staff salaries (\$3.66/patient/year;32%).

Conclusions: For only 2–4% estimated additional costs, hypertension care was added to HIV care, and also expanded to all HIV-negative patients in prototypic Ugandan clinics, demonstrating substantial synergy. Our results should encourage accelerated scale-up of hypertension care into existing clinics.

Keywords

HIV; hypertension; microcosting; non-communicable diseases; integration

INTRODUCTION

Many Sub-Saharan African nations with a substantial HIV burden are now facing dual epidemics of HIV and non-communicable diseases including hypertension and its associated cardiovascular morbidity and mortality. This is increasingly being recognized as a growing and urgent health threat, with the greatest rise in mortality projected to occur in Africa.^[1–3] The prevalence of hypertension among adults in Sub-Saharan Africa has been estimated at 21.2–30% in two recent systematic reviews,^[2, 4] fueled by trends of urbanization and associated reductions in exercise, as well as dietary changes and increased tobacco and alcohol.^[5, 6]

Data are emerging on the effectiveness of hypertension control programs,^[7] but workforce shortages, procurement challenges and high prices of antihypertensive medications are pervasive.^[8, 9] In East Africa, although national guidelines are widely recognized, longitudinal hypertension treatment programs are not widespread. Where they do exist, they are often suboptimally integrated into the overall healthcare infrastructure,^[10] thus far limiting their effectiveness.^[11, 12] Costs for hypertension care are currently very high, both to patients and health systems. For patients, care is commonly received in private healthcare systems with high costs of frequently brand-name rather than generic medicines as well as visit fees for hypertension care being borne directly by patients.^[9]

In Tanzania, a study estimated the cost of cardiovascular disease prevention through hypertension care at health centers at \$30–41/person/year.^[13] In Kenya, one study spanning public and private health centers found hypertension medicine costs ranging from \$26–\$234/person/year in public facilities versus \$418–\$987/person/year in private facilities.^[14] while another demonstrated a mean \$36/person/year cost for hypertension medications in public facilities.^[15] Similar high direct costs to hypertension patients of \$67/year have been reported in Nigeria,^[16] while in Malawi, over 20% of households seeking non-communicable disease care incurred levels of spending that were judged as catastrophic.^[17]

These and other studies have raised broad concern that high costs, predominantly borne by patients rather than the health system, will prevent broad scale-up of hypertension care.^[18]

A key global priority has therefore been the integration of care for hypertension and other non-communicable diseases into the HIV chronic care infrastructure,^[3, 19] which relies centrally on government-run networks of clinics to provide HIV services. This call has been backed by the Joint United Nations Program on HIV/AIDS (UNAIDS),^[20] the World Health Organization,^[1] and the Sustainable Development Goals agenda.^[21] The envisioned goal is to build on the model of long-term HIV care that already provides medications, clinical monitoring, and therapy adjustments, and deliver joint care for hypertension and other non-communicable diseases in the same infrastructure. Further, this may help destigmatize HIV care by generalizing services offered in clinics far beyond just HIV services.^[22]

To achieve these ends, policymakers and finance and health ministers need cost data on hypertension care programs, and in particular, what costs are for integrating hypertension care into HIV care. While literature on the effectiveness of integrated care is growing ^[19], there are no large studies to date in Sub-Saharan Africa reporting costs of integrating of hypertension care into chronic HIV care.^[23] This lack of data is an impediment to policy adoption of integrated HIV/hypertension care models.

The SEARCH Study is a community-based cluster randomized trial of a test-and-treat approach to HIV and non-communicable disease care that we have conducted in rural East African communities in Uganda and Kenya. SEARCH tested a streamlined system for HIV and hypertension testing at health fairs^[24] and a system of streamlined delivery of care at government run healthcare facilities.^[25, 26] The SEARCH intervention achieved 79% population-level viral suppression, exceeding UNAIDS 90-90-90 HIV goals.^[26, 27] At baseline, adult hypertension prevalence ranged from 10–13%.^[22] SEARCH achieved a population-wide 26% improvement in the prevalence of hypertension control during three years of study.^[27]

To address data gaps and inform global policy discussions, we sought to estimate the cost for delivering hypertension care integrated with HIV care for HIV-positive individuals, as well as the cost for delivering hypertension care to HIV-negative people in the same clinics.

METHODS

Study Setting.

The SEARCH Study (NCT:01864603) was a community-based cluster randomized trial of a universal test-and-treat strategy for HIV using a multi-disease approach conducted from 2013 to 2017 in 32 rural communities in rural Uganda and Kenya.^[27] Approximately 10,000 persons reside in each community, of which approximately half are adults aged 18 years. As reported previously, following a baseline census, each community held a community health campaign (CHC) offering multi-disease screening and linkage to care for HIV, hypertension, and diabetes.^[24] Persons ascertained with any of these conditions were linked to care at a nearby health center. In this analysis, we assessed the cost of integrating

hypertension (HTN) care into existing government supported HIV care clinics in the 10 Ugandan communities that participated in the intervention arm of the SEARCH Study.

Ethics Statement.

The SEARCH Study was approved by institutional review boards at Makerere University College of Health Sciences (Kampala, Uganda), the Kenya Medical Research Institute (Nairobi, Kenya), and the University of California, San Francisco, as well as by the Uganda National Council for Science and Technology.

Hypertension Diagnosis and Linkage to Hypertension Care.

Participants who screened positive for hypertension at the CHC [defined as either (1) systolic BP ≥ 140 mm Hg or diastolic BP ≥ 90 mm Hg on three measurements, per World Health Organization (WHO)^[28, 29] and Uganda National hypertension guidelines,^[30] or (2) self-reported current use of anti-hypertensive medications] were referred to their local health facility for treatment. As reported previously, SEARCH delivered a multi-disease streamlined model of care at clinics offering integrated treatment for HIV, hypertension and diabetes. The streamlined care model has been previously described and included patient-centered care, training on fostering a welcoming clinic environment, rapid clinic transit resulting in reduced wait times, and telephone hotline access for patients to ask clinical advice or for appointment rescheduling.^[26] HIV-positive patients received care for HIV and HTN in integrated fashion during single clinic visits. HIV-negative persons received treatment for hypertension at the same clinics, typically on scheduled days devoted to seeing patients with hypertension.

Diagnosis and Management of Hypertension.

Hypertension was verified upon entry to care, and patients were offered therapies following Uganda national guidelines^[30] that begin with lifestyle modification followed by therapeutic medications. As we previously reported, Stage 1 hypertension patients (SBP ≥ 140 or DBP ≥ 90 on three measurements) were given a 3-month trial of lifestyle modifications (increased exercise, and dietary changes).^[27] If hypertension persisted (i.e., stage 2), a thiazide (Bendroflumethiazide) was prescribed; if BP remained elevated after 4 weeks (i.e., stage 3), a calcium channel blocker (nifedipine) was added. For persistent HTN, an angiotensin converting enzyme (ACE) inhibitor (captopril) was added. All patients with malignant hypertension (BP $\geq 180/110$ mmHg) were immediately referred for urgent treatment at the health facility. Patients with controlled blood pressure were followed up every 3 months, or sooner if drug supply for 3-month refills was not available. Laboratory monitoring per care protocol specified urinalysis.^[27]

Data Collection.

We collected information to estimate the costs of two central parameters: (1) for HIV-positive participants, the cost of adding HTN care on top of existing HIV care available at the clinics, and (2) for HIV-negative participants, the de novo cost of providing HTN care that was previously only available by referral to regional care hospitals rather than locally at the clinics.

We conducted two-week long site visits to the Ugandan clinics (n=5 in Western Uganda and n=5 in Eastern Uganda, total n=10) participating as intervention sites of the SEARCH Study between July 2015 and June 2016 using previously published methods.^[31, 32] Study teams in each region collected cost data using a standard protocol and tools. Teams recorded the economic value of all resources used, regardless of the funding source. All costs were recorded as 2016 US dollars. We ascertained all costs within five key categories comprising streamlined care delivery for patients with HTN including: (A) personnel, (B) hypertension medications, (C) laboratory testing (D) other recurrent costs and (E) fixed costs (see Appendix 1 for detailed description of data sources and calculation of each component of total cost).

Staff interviews: We interviewed SEARCH Study coordinators to obtain information on the types and amounts of resources (e.g. SEARCH clinic staff, HTN medications) needed to support care for patients with HTN. We interviewed health facility managers to obtain information on the types and amounts of health facility resources needed to support care for patients with HTN, (e.g. staff salaries and benefits, unit costs for laboratory testing supplies, and other recurring and fixed goods and services) and to estimate the costs of resources for which administrative records were not available (e.g. utilities and facility costs).

Administrative records review: We reviewed SEARCH Study administrative records to obtain information on staff salaries and benefits and the costs of HTN medications. We reviewed health facility administrative records to obtain information on costs of recurring goods and services (e.g. laboratory testing supplies) consumed during the two-week costing period of analysis.

Time and motion study: We conducted a time and motion study in each of the ten clinics in order to establish the proportion of total work time in a given day that clinic staff spent providing care for HIV-positive and HIV-negative patients with HTN. Clinic personnel who either directly provided care or supported the provision of care for patients with HTN maintained and completed 24-hour time records of their activities during each day of the two-week observation period. Staff recorded the number of minutes they spent in each of six categories: (1) direct in-person service with patients; (2) on the phone with patients; (3) working on tasks for patients; (4) conducting non-clinical SEARCH Study research work; (5) performing other work; and (6) time spent waiting for the next patient, idle or on a scheduled break.

Patient visit analysis: In each community, for the 12-month period after the community health campaign, we tabulated the total number and types of patients seen each day during the two-week observation period (i.e., HIV-positive with and without HTN, and HIV-negative with HTN). From clinical records, we also obtained data on visits conducted and hypertension medications prescribed during the 12-month period.

Estimation of Total Cost of Hypertension Care.

Using the above inputs, for each community, we estimate the cost per patient per year of adding HTN care for both HIV-positive and HIV-negative patients as a sum of the five cost

categories: personnel, HTN medications, laboratory testing, other recurrent goods and services, and fixed costs. A detailed description of each category is given in Appendix 1.

Sensitivity Analysis of Cost of Hypertension Care.

We modeled two scenarios of variable costs, one in which all cost components were 50% less expensive than observed, and one in which all components were double of observed costs.

RESULTS

Characteristics of Health Facilities and Patients.

We assessed HIV-positive and HIV-negative patients in 10 health facilities participating in the SEARCH Study HIV test-and-treat trial during the second of three years of study intervention, during 2015–2016. A total of 70 HIV-positive patients and 2355 HIV-negative patients received care for HTN during this second follow-up year, making a total of 311 and 8,708 visits, respectively across all ten clinics. Average visits per year for HIV-positive and HIV-negative patients was 4.4 and 3.7, respectively, consistent with the standardized schedule of visits on a 3-monthly schedule within SEARCH streamlined care. During the two-week cost observation periods, patients with HTN (both HIV-positive and HIV-negative) made a total of 509 recorded visits (range, 13–77 per site). A total of 47 clinic staff members (range, 3–7 per site) supported HTN services on a specific day each week; these staff also provided general HIV streamlined care on other days of the week. Individual patients with HTN received care from 1–4 clinic staff members.

Personnel Effort for Hypertension Care.

We assessed the time that clinic staff members spent working on tasks related to the provision of care for patients with HTN (Table 1), and the fraction of their total work effort devoted to the once per week HTN clinics. Hypertension care was led by clinical officers (mean effort, 15.7% of total time) and nurses (mean effort, 14.7% of total time). These estimates varied substantially between health facilities (range, 1.8%–48.1% for clinical officers and 9.7%–24.2% for nurses), due to differences in the numbers of hypertensive patients registered at different clinics. Laboratory technicians spent relatively less time with patients, and experienced considerable down-time between patients; their fraction of active work time (that excludes down-time) thus was highest at 26.7%. Peer intake and education staff spent who perform intake and education spent a mean 19.8% effort on HTN care.

Hypertension Medication Regimens.

Far more HIV-negative than HIV-positive patients were registered and treated for hypertension. As shown in Table 2, medications were more frequently prescribed to HIV-positive patients than to HIV-negative patients, with 93% (57/61) of HIV-positive patients with HTN medication data receiving at least one HTN medicine, versus only 68% (1603/2355) of HIV-negative HTN patients receiving 1 medicine. Accordingly, mean number of annual visits for hypertension care was slightly higher among HIV-positive versus HIV-negative patients (4.4 vs. 3.7 visits/year, respectively). Within both groups, visits per year increased as more medications were prescribed, due to more frequent monitoring.

Overall Costs of Hypertension Care Delivery.

For HIV-positive individuals, provision of HTN care added an average of \$6.29 per person per year to the baseline costs of streamlined HIV care (Table 3). We previously reported costs of HIV streamlined care delivery as an average \$291 per person per year;^[33] thus, an \$6.29 increase represented a 2.1% marginal increase in total costs of care for adding HTN services. For HIV-negative individuals, the cost of adding HTN care into the chronic general medical care offered at clinics was \$11.39 per person per year, representing a 3.8% marginal increase in cost (Table 3).

For HIV-positive patients, since the marginal costs of adding HTN care into existing streamlined HIV care did not involve additional personnel or fixed and recurring costs, and did not extend the duration of time with clinical providers, the resources needed were dominated by costs of anti-hypertensive medications (\$6.19/person/year; 98% of total); the modeled cost of HTN-related laboratory tests (urinalysis, \$0.10/person/year) were minor. For HIV-negative patients, because HTN care represented new service delivery, costs included personnel (\$3.66/person/year), as well as fixed, recurring, and laboratory (urinalysis) costs (\$1.98, \$0.56 and \$0.10/person/year, respectively), but were still dominated by the cost of anti-hypertensive medications (\$5.09/patient/year; 45% of total cost).

Variability in Costs.

As shown in Figure 1, we estimated the variability around total hypertension care costs ranging from 50% to 200% of our observed estimates detailed above. For HIV positive patients, the cost of integrating HTN care into HIV care thus ranged from \$3.14 (50% estimate) to \$12.57 (200% estimate) per patient per year (Figure 1), representing marginal additional costs beyond HIV care of 1.2% to 4.7%. For HIV-negative patients, the cost of delivering HTN care varied more widely, and ranged from \$5.70 (50% estimate) to \$22.79 (200% estimate) per patient per year (Figure 1), representing marginal cost increases of 2.0%–7.7%, respectively.

DISCUSSION

Within the SEARCH HIV test-and-treat trial, we estimated the costs of providing hypertension care embedded with streamlined HIV care. We demonstrate hypertension care can be added at very low marginal cost above existing HIV care costs. For HIV-positive patients, hypertension care added only \$6.29 to the estimated \$291.61 cost of streamlined HIV care,^[33] thus representing only a 2.1% marginal increase in total cost to add hypertension services. This is highly economical and should add momentum to broad ongoing global conversations on how to better deliver care for non-communicable diseases. To our knowledge, this is among the first studies to directly examine the costs of integrating care for hypertension into an existing chronic HIV-focused healthcare system in Sub-Saharan Africa.

SEARCH was designed to address HIV within a broad community health context, inclusive of both HIV and noncommunicable diseases like hypertension, and sought to improve

overall community health. We implemented integrated hypertension and HIV care, and also reached a far larger population of HIV-negative patients with hypertension. We show here that hypertension care for HIV-negative patients cost an average of only \$11.39/person/year, representing only a 3.8% marginal increase in costs already being spent to deliver care to HIV-positive patients. These data should support expansion of services in traditionally HIV-focused clinics to HIV-negative individuals with non-communicable diseases. Apart from low marginal costs, we also found raw costs for hypertension care to be very low.

Our marginal costs for hypertension care were less than half of previously published estimates for standalone hypertension care in Tanzania, Kenya and Nigeria (\$30–41, \$26–\$234, and \$67 per person per year, respectively).^[13–16] Two factors were key in contributing to these low marginal costs: (1) hypertension care was delivered in synergy with HIV care already being provided, allowing sharing of clinic resources, staff, and infrastructure, and (2) generic hypertension medicines were procured through the Uganda national medical supply chain, allowing our system to avoid higher cost branded medicines and thus minimizing costs. Given these low marginal costs, our data argue for greater attempts to integrate care into HIV infrastructure.

In examining the components of costs of delivering hypertension care, we found that hypertensive medications are the dominant cost component for delivering care. The fact that these medicines are generically produced, and available at low cost in Sub-Saharan African healthcare systems, is consistent with a care delivery system for hypertension that is lean and efficient. A system in which necessary hypertension medicines comprise the majority of total costs (rather than personnel or fixed and other recurrent costs) should encourage implementation science and healthcare efficiency experts focused on maximizing care at minimal cost. Large nationalized health systems will need to prioritize their ability to efficiently purchase and deliver hypertension medications to rural health clinics at low cost.

Our study has several important limitations. In our patient sample, we had a relatively small number of HIV-positive patients with hypertension. This is because HIV prevalence was approximately 6% among adults, and only a proportion had hypertension. Although sample size of HIV-positive patients was small, we were able to carefully measure costs, and our analysis benefited from a comparatively much larger number of HIV-negative patients with hypertension, reflective of the East African epidemic.^[2] Second, streamlined care in the SEARCH Study was implemented as part of a broader HIV care system in which some patients received standard services alongside others receiving streamlined services. To isolate streamlined care costs, we conducted self-administered time-and-motion studies. However, accuracy of these assessments could be affected if staff members underestimated time needed for certain tasks or did not fully record break/waiting time. We minimized this risk by using simple tools allowing staff to fully capture downtime. Third, we did not capture which laboratory tests were used for care of HIV-positive versus HIV-negative patients with hypertension; our analysis assumed similar usage patterns for each visit. Since HIV-positive patients appeared to have more advanced hypertension overall than HIV-negative patients, our costs of care for HIV-positive patients may have been underestimated to the degree that laboratory tests contribute. Fourth, we did not have documentation of certain facility costs including rent (part of fixed costs) or utilities (part of recurring costs);

these were estimated via interviews with clinic managers. Despite this limitation, however, our previous estimates of the cost of streamlined care were within range of other prevailing estimates for HIV care delivery.^[33]

In this study, we demonstrate that integration of hypertension care into prototypical HIV-focused care clinics in East Africa can be achieved at very low cost, representing only a 2.4–4.0% marginal increase in costs already being expended on HIV care. For HIV-positive patients with hypertension, this represents a clear opportunity to care for hypertension—a chronic condition with consequences for undertreatment—in tandem with HIV. For HIV-negative patients with hypertension, many patients currently cannot access therapy; our data should provide encouragement that not only can these patients be cared for within HIV-focused clinics, but they can be treated at low marginal cost, and with the added benefits of making clinics less HIV-centered and more rooted in the provision of general medical care. Building on prior literature, our data can inform resource allocation decisions in the scale up of integrated chronic care delivery. More cost analyses are needed on integration of other non-communicable diseases like diabetes and cardiovascular conditions like hyperlipidemia and coronary artery disease. This will help achieve large-scale policy goals of transforming the HIV care infrastructure in Sub-Saharan Africa into a system capable of delivering broader, truly universal health care.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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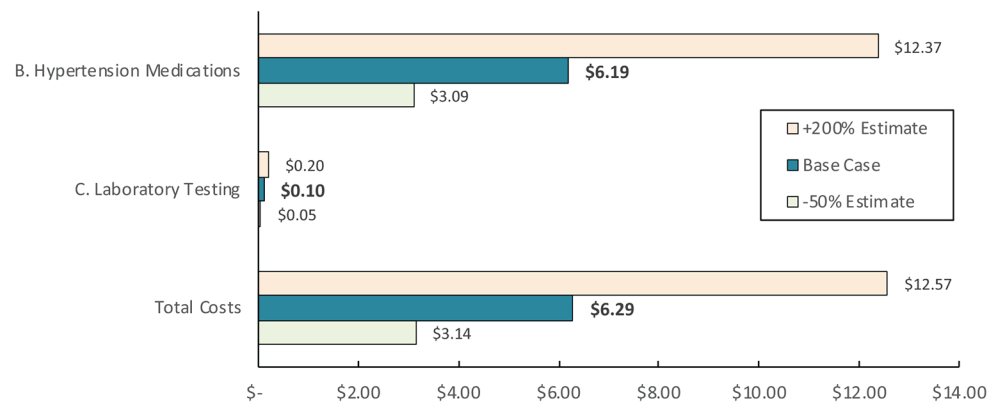
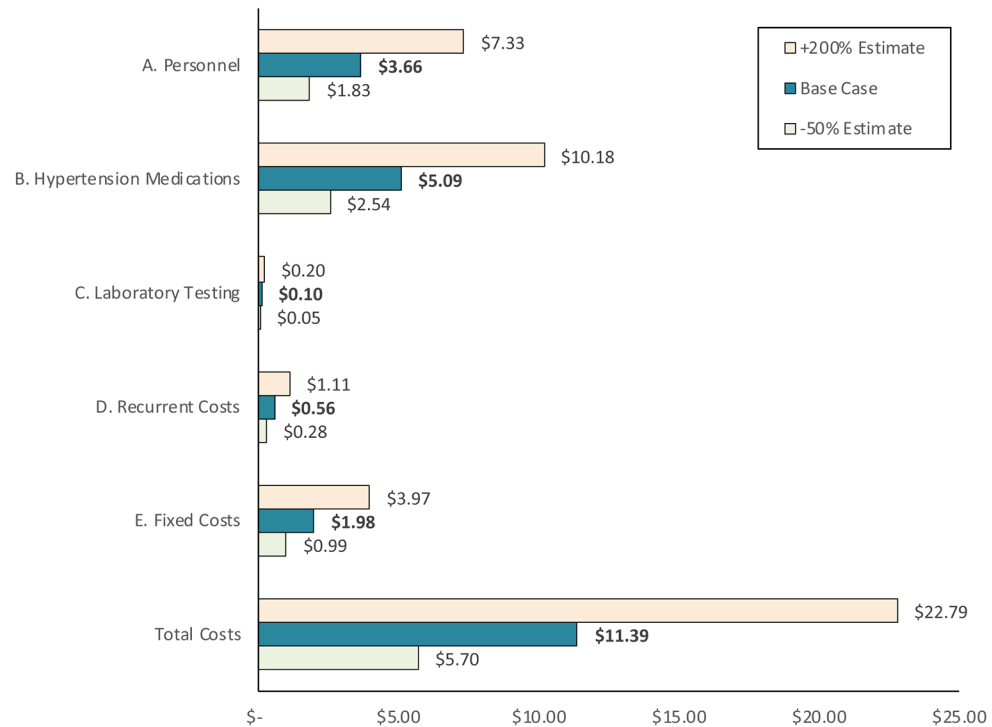
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A. HIV-Positive Hypertension Patients**B. HIV-Negative Hypertension Patients****Figure 1. Sensitivity Analysis of Variation in Costs of Hypertension Care**

Sensitivity analysis showing costs for hypertension care to HIV-positive patients (panel A) and HIV-negative patients (panel B). For each, estimated average per-person per-year costs for hypertension care are shown in 2016 USD for the observed (base case) scenario (blue bars), as well as a scenario in which cost components are reduced to 50% of observed (green bars), and a scenario where cost components are increased to 200% of observed (orange bars). For HIV-positive patients already receiving streamlined HIV care, the cost of hypertension care includes components of hypertension medicines and laboratory testing

costs. For HIV-negative patients, cost of hypertension care additionally includes components of personnel effort, recurrent costs, and fixed costs.

Table 1.

Personnel Effort Spent Treating Patients with Hypertension by Region

	Mean per clinic	Clinic Minimum – Maximum
Clinical Officer	15.7%	1.8% – 48.1%
Nurse	14.7%	9.7% – 24.2%
Laboratory Technician	26.7%	0.9% – 73.2%
Peer^A	19.8%	0.0% – 24.2%
Data/Information Officer	1.7%	0.0% – 10.9%

^A: Peer staff included Community Health Assistants and Peer Educator

Table 2.

Treatment Regimens among HIV-positive and HIV-negative SEARCH Study Participants with Hypertension

Patients	Overall	Treatment Regimen				
		Lifestyle Modification	1 medicine	2 medicines	3 medicines	No data
HIV-positive						
N (%)	70 (100)	4 (6.6)	21 (34.4)	29 (47.5)	7 (11.5)	9
Annual Visits (mean)	311 (4.4)	43 (10.8)	82 (3.9)	143 (4.9)	36 (5.1)	7
HIV-negative						
N (%)	2355 (100)	752 (31.9)	582 (24.7)	798 (33.9)	223 (9.5)	—
Annual Visits (mean)	8708 (3.7)	1393 (1.9)	2428 (4.2)	3811 (4.8)	1071 (4.8)	5

Table 3.

Annual Cost of Hypertension Treatment in HIV-Positive and HIV-Negative Participants

	Cost per Person per Year (ppy)	
	Mean	Clinic Range (Minimum – Maximum)
HIV-positive participants		
Personnel	—	—
Medications	\$6.19	(\$0.00 – \$8.81)
Laboratory testing	\$0.10	—
Other recurring costs	—	—
Fixed costs	—	—
Total	\$6.29	(\$0.10 – \$8.91)
HIV-negative participants		
Personnel	\$3.66	(\$0.76 – \$27.56)
Medications	\$5.09	(\$3.45 – \$6.75)
Laboratory testing	\$0.10	—
Other recurring costs	\$0.56	(\$0.00 – \$2.63)
Fixed costs	\$1.98	(\$0.44 – \$7.07)
Total	\$11.39	(\$7.02 – \$32.68)