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Economic Evaluation

Cost-Effectiveness of an Enhanced Patient Care Intervention for Improving Viral Suppression Among Kenyan Adults Living With HIV



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ABSTRACT

Objectives: Patient-centered interventions can improve care engagement and treatment adherence for people living with HIV (PLWH). Yet, evidence on their cost-effectiveness remains sparse, hindering their prioritization over alternative models. This study estimated the cost-effectiveness of a patient-centered intervention for improving viral suppression among PLWH in western Kenya.

Methods: We analyzed the cost-effectiveness of an enhanced patient-centered (EPC) intervention via a randomized pilot trial among 328 PLWH in 2 rural clinics. The EPC arm included clinician-patient continuity, treatment dialogue, and flexible scheduling. The provider-patient communication (PPC) arm provided training on motivational interviewing. The standard of care arm provided patient-specific interventions to promote viral suppression. Costs were aggregated across the 2 clinics and measured from a societal perspective, including patient time, transportation, and medication. The incremental cost per disability-adjusted life year averted was calculated based on patient virologic failure risk, HIV transmissions averted, and life expectancy. Key parameters were varied by $\pm 25\%$ to examine uncertainty in incremental cost-effectiveness ratios.

Results: Compared with standard HIV care, both the EPC intervention and PPC training alone were more cost-effective at various willingness-to-pay thresholds. Providing PPC training alone was the dominant strategy (more effective and less costly) compared with the EPC intervention at \$97.72 per HIV infection averted and \$4.44 per disability-adjusted life year averted. Both interventions were cost savings when factoring in lifetime HIV treatment cost averted.

Conclusions: Patient-centered care models may be highly cost-effective for improving treatment outcomes among PLWH. These encouraging results warrant further testing in fully powered clinical trials.

Keywords: cost-effectiveness, East Africa, HIV, patient-centered care, viral suppression.

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Introduction

HIV has been the leading cause of death and disability in Kenya since the mid-1990s.¹ The country's HIV epidemic is one of the largest globally, with approximately 1.4 million people living with HIV (PLWH) in 2022 and a prevalence rate of 3.7 among adults.² The implementation of Kenya's updated 2016 guidelines on the use of antiretrovirals for HIV treatment and prevention³ has rapidly increased access to life-saving treatment. However, adoption of the "treat-all" guidance has also increased costs by an estimated 20% from earlier treatment protocols that were based on achieving the UNAIDS 90-90-90 targets.⁴ At the same time, multilateral funding for HIV treatment has largely plateaued since 2008 despite rising numbers of PLWH in the country.^{5,6} Thus, there is an increasingly urgent need for evidence-based approaches that can support retention in care, antiretroviral adherence, and viral suppression while minimizing care delivery costs.

Patient-centered care (PCC) models are becoming more common in the context of HIV service delivery to address individual, social, and structural barriers to treatment adherence.⁷ These models place the patient as an active decision maker in their care, providing services that are supportive, accessible, and culturally tailored to patient needs and preferences. In high-income countries, there is evidence of positive impacts of PCC on care satisfaction and treatment self-management.⁸⁻¹⁰ But there is a need to understand how PCC models can be implemented and sustained in settings with high patient volume and fewer resources. Despite calls to advance PCC as the status quo for HIV care in sub-Saharan Africa (SSA),^{7,11,12} limited capital and human resources continue to be a key barrier to wider implementation.¹³

Patient-centered models that focus on improving management of HIV and other chronic conditions have shown to improve quality of life and reduce costs of care in the United States, Canada, and other high-income countries.^{14,15} In contrast, there is minimal

available evidence surrounding the cost-effectiveness and potential cost savings of using patient-centered approaches to improve clinical outcomes for persons with chronic conditions in SSA.¹⁶⁻¹⁸ The goal of this economic evaluation was to estimate the cost-effectiveness of a client-centered enhanced patient care (EPC) intervention that was piloted and found to be effective for improving viral suppression among PLWH in 2 rural clinics in western Kenya.¹⁹ We hypothesized that the enhanced patient care intervention would be more costly compared with standard HIV services but would be more cost-effective in the short to medium term. Evidence from this cost-effectiveness analysis can help inform resource allocation decisions in low- and middle-income countries with generalized HIV epidemics.

Methods

The EPC Intervention

The EPC model was piloted from August 2019 to March 2020 using a 3-arm randomized controlled trial¹⁹ among 328 adult patients of 2 HIV health facilities affiliated with the Academic Model Providing Access to Healthcare (AMPATH)^{20,21} in western Kenya. Participants were randomized into 3 intervention arms: (1) EPC, $n = 110$) intervention in addition to provider-patient communication training and standard of care (SOC), (2) provider-patient communication (PPC) training intervention (PPC, $n = 110$) in addition to SOC, or (3) SOC ($n = 108$) only. The EPC intervention included (1) clinic scheduling, in which patients and clinicians mutually agreed upon the date and time of their next appointment, (2) provider-patient continuity, in which patients were seen by the same provider for the study duration, (3) improved treatment dialogue, in which providers (i) followed a motivational interviewing approach²² to identify the key factor(s) motivating patients to engage in their care regimen and (ii) kept a written summary of each patient interaction to refer to across the patient's care continuum, (4) peer navigators, who discussed the treatment dialogue notes with patient and assessed patients' understanding of their clinical encounter, and (5) PPC training, during which providers attended a 2-day interactive workshop on communication standards in a clinic setting, provider-patient relationship dynamics, and motivational interviewing techniques. Standard HIV care visits included adherence counseling and/or other patient-specific interventions to promote viral suppression, with appointments scheduled for a given day only (without a specified appointment time) and patients seen on a first come, first serve basis. All trial participants were virally unsuppressed at study enrollment (viral load ≥ 400 copies HIV RNA/mL within 3 months of enrollment). The trial assessed the impact of EPC and PPC on viral suppression (main outcome), clinical adherence (secondary outcome), and PPC skills (secondary outcome) at 6 months after intervention. The model adjusted for any covariates across the 3 study arms at baseline and applied logistical regression with statistical tests conducted at $P \leq .05$. The primary outcome of viral suppression was defined as a viral load < 400 copies HIV RNA/mL. Additional details of the trial's methods and effectiveness results have been published elsewhere.¹⁹

Collection of Cost Data

We used a microcosting approach to estimate the cost per participant in each trial arm. After the trial end date, costs were collected from both clinics retrospectively from August 2019 to January 2020 via reviews of study records and informational meetings with project budget managers for both health clinics. Bottom-up data collection included costing supply and equipment

inventories and tracking patient flow. Top-down data collection included personnel and program implementation costs and gross costing of direct treatment costs^{4,23} and overhead and recurrent costs.²⁴ Patient-level resource utilization data (eg, number of viral load tests performed) were collected using AMPATH's electronic medical record system. The time spent at each encounter for both patients and providers were collected using AMPATH's point-of-care platform. Patient travel time and foregone wages due to care seeking was estimated via informational interviews and averaged for each arm across both clinics.

Costs were measured from a societal perspective, which included facility, provider, program, patient, and opportunity costs. Opportunity costs including patients' lost productivity from time spent traveling to, waiting for, and participating in their schedule clinic visit.^{25,26} To determine the average cost of patients in the EPC intervention arm compared with those in the PPC and SOC groups, costs were allocated based on the total fixed and variable cost components from both health clinics. Variable costs included patient treatment and testing, medical supplies, and opportunity costs. Fixed costs were those that were independent of the number of intervention recipients and included program implementation and training, medical equipment, and facility overhead and administration. The fixed costs of the program were allocated based on the total number of patient visits per year. Time allocation was used to assign indirect and joint costs across the intervention arms based on person hours spent in care delivery. Costs were calculated as per patient per year based on clinic utilization, and costs were aggregated across both clinics.

Incremental Effectiveness

On measures of intervention effectiveness, the study showed a positive impact on viral suppression and clinical PPC skills but not a statistically significant impact on the clinic appointment adherence outcome. The primary effectiveness outcome (number of patients virally suppressed in both health clinics) was measured 6-months after intervention in the pilot trial and aggregated across both clinics for this analysis.¹⁹ To estimate the incremental effectiveness of the EPC intervention between trial arms after 1 year, we assumed a 5% risk of virologic failure while on ART from 6 months to 1 year based on the literature (ie, 5% fewer patients would be suppressed at 12-month after intervention compared with 6-month after intervention).²⁷ The assumption enabled the analysis to assess both incremental cost and effectiveness along the same 12-month time frame. For this cost-effectiveness analysis, incremental effectiveness was the difference in the number of patients virally suppressed (viral load < 400 copies HIV RNA/mL) at 12-months between the 3 trial arms, comparing viral suppression in the EPC intervention arm with SOC alone, the PPC intervention arm with SOC alone, and in EPC intervention arm with the PPC intervention arm.

Incremental Cost-Effectiveness Analysis

We estimated the cost-effectiveness of the intervention as the incremental cost per disability-adjusted life year (DALY) averted, comparing the comprehensive EPC intervention and the PPC intervention with SOC. The incremental cost per DALY averted was calculated using the equation:

$$[(C - AT) / AD],$$

where C was the incremental intervention cost over 1 year (for EPC intervention compared with PPC, for EPC compared with SOC, and for PPC compared with SOC), A is the number of individuals receiving the EPC intervention and virally suppressed at 1 year, T

is the lifetime treatment costs saved per HIV infection prevented by the intervention, and D is the DALYs averted because of prevented HIV infections when virally suppressed. The incremental cost-effectiveness ratio (ICER) calculation method was selected based on a published cost-effectiveness analysis of another EPC intervention.¹⁵ To estimate the number of DALYs averted in each trial arm, we assumed that 0.0046 HIV transmissions were averted per each virally suppressed patient,²⁸ 22 DALYs averted per new HIV infection prevented,²⁹ and \$13 192.50 in lifetime HIV treatment costs per person³⁰ (Table 1).²⁸⁻³³ The lifetime HIV treatment costs per person was calculated using the following equation: (median annual economic cost for established adult patients on ART in Kenya) $\times$ [(average life expectancy for PLHIV in sub-Saharan Africa) – (average age of HIV diagnosis in Kenya)]. Using secondary literature, the lifetime treatment cost saved per HIV transmission averted (T) was calculated as follows for 2019 USD: [(median annual economic cost for established adult patients on ART in 2011/gross domestic product (GDP) Deflator in 2011] $\times$ GDP Deflator in 2019) $\times$ (Average years on HIV treatment) or [(248.91/113.11] $\times$ 192.905) $\times$ (61.077–30).³⁰⁻³³

Historically, cost-effectiveness has been predefined in relation GDP per capita—for Kenya in 2019, this would equate to \$1970—for which an incremental cost-effectiveness ratio below 1 time the per capita GDP is considered highly cost-effective (eg, ICER $\leq$ \$1970), and below 3 times the GDP per capita was cost-effective (eg, ICER $\leq$ \$5910).³⁴ However, relying on GDP-based thresholds in local settings (particularly low- and middle-income countries) for health intervention decision making has been questioned because of the lack of attention to local context and factors (eg, potential budget impact, feasibility based on infrastructure and supply chain, and opportunity cost from resource constraints).³⁴⁻³⁶ Additionally, the cost-effectiveness of the intervention was compared with additional willingness-to-pay thresholds of 0.01, 0.5, and 1.0 times Kenya's per capita GDP to show how the intervention may still be cost-effective when compared with range of cost-effectiveness thresholds commonly used in the literature.³⁶⁻³⁸ Thus, the intervention was considered cost saving if the cost to implement the enhanced patient care model was less than the lifetime HIV treatment costs averted ($C < AT$).³⁹ Costs were initially record in Kenyan Shillings and converted to US dollars using the June 1, 2019 United National Operational Exchange Rate (101.25 KES = \$1 USD).³³ All cost data collection and cost-effectiveness analyses were performed using Microsoft Excel version 2019 (see Appendix 1 in Supplemental Materials found at <https://doi.org/10.1016/j.vhri.2025.101129>).

Table 1. Parameters used for the incremental cost-effectiveness analysis.

	Base-case assumption	Source
Average life expectancy for PLWH in sub-Saharan Africa	61.077	31
HIV transmissions averted per patient virally suppressed (t)	0.0046	28
DALYs averted per HIV transmission averted (D)	22	29
Lifetime treatment cost saved per HIV transmission averted (T)	US\$13,192.50	30-33

DALY indicates disability-adjusted life year; PLWH, people living with HIV.

Sensitivity Analysis

One-way sensitivity analysis and probabilistic sensitivity analysis were conducted to evaluate the robustness of the cost-effectiveness results. Key parameters were varied by $\pm 25\%$ to assess the impact of uncertainty on incremental cost-effectiveness ratios, whereas probabilistic analysis estimated the probability of the intervention being cost-effective at different willingness-to-pay thresholds.

Results

Intervention Costs

The annual setup cost for the EPC program overall was \$3908.48 (\$2862.53 for capital setup costs and \$1045.95 USD for recurrent peer navigator salaries; overall program cost data not reported in Table 2,³³ only as cost per patient). Table 2³³ shows the annual cost per patient in each arm of the trial as both direct and indirect costs. Total annual per-patient costs were \$462.57, \$452.25, and \$443.71 for those receiving EPC, PPC, and SOC, respectively. The main drivers of cost differences between arms were peer navigators, productivity losses from time spent attending clinic visits, and clinical officer costs. Annual productivity losses from clinic visit time were lowest among EPC recipients, \$4.43 per EPC patient compared with \$5.82 per PPC patient and \$7.41 per SOC patient. Patients receiving EPC, PPC, and SOC spent an average of 8.9, 5.9, and 6.2 minutes with providers at each visit, respectively. The average number of clinic visits per year was 9.2 visits for EPC patients, compared with 8.5 for PPC patients and 10.0 visits for SOC patients. This translated into a clinical officer cost based on time per patient per clinic visit of \$1.68 for the EPC intervention, \$1.02 for PPC, and \$1.27 to deliver SOC. The cost of having peer navigators review providers' dialogue notes with patients receiving the EPC intervention was \$9.51 USD per patient per year.

The incremental cost of the EPC model compared with SOC was \$18.86 (\$462.57–\$443.71) per patient per year. The incremental cost of the PPC to SOC was \$8.54 (\$452.25–\$443.71) per patient per year. The incremental cost of the EPC model compared with the PPC was \$10.32 (\$462.57–\$452.25) per patient per year. The ICERs of both the EPC and PPC interventions compared with SOC were less than the lifetime HIV treatment cost averted (\$13 192.50), implying that the intervention strategies were cost saving.

Cost-Effectiveness

A total of 77 and 83 patients were estimated to be virally suppressed 12-months after intervention in the EPC and PPC arms, respectively. In the SOC arm, 64 patients were estimated to be virally suppressed 12-month after intervention. As described above, these estimates are based on the extrapolation of the observed 6-month data on viral suppression to cover a full year of the intervention using an assumption of a 5% risk of virologic failure while on ART from 6 months to 1 year based on the literature.²⁷ Compared with standard HIV care recipients, the incremental number of patients virally suppressed at 1 year after intervention was 13 among EPC intervention recipients and 19 among PPC recipients. The incremental number of patients virally suppressed was lower among EPC intervention participants compared with PPC intervention participants (–5.65).

As shown in Table 3, the incremental cost per EPC patient virally suppressed relative to SOC was \$1.41; the incremental cost per PPC patient virally suppressed relative to SOC was \$0.45. The ICER of EPC relative to PPC was –\$1.83, showing the EPC

Table 2. Annual costs per patient by intervention arm and cost category (2019 US\$).

Cost	Arm: EPC	% of total cost (EPC)	Arm: PPC	% of total cost (PPC)	Arm: SOC	% of total cost (SOC)
Direct costs						
Recurrent costs						
Clinical personnel salaries						
Clinical officers	1.68	<1%	1.02	<1%	1.27	<1%
Nurses	0.54	<1%	0.54	<1%	0.54	<1%
Testing staff	0.22	<1%	0.22	<1%	0.22	<1%
Care and treatment staff	0.62	<1%	0.62	<1%	0.62	<1%
Nonclinical personnel salaries						
Peer navigators	9.51	2%	-	2%	-	2%
Social workers	0.50	<1%	0.50	<1%	0.50	<1%
Lay workers	0.17	<1%	0.17	<1%	0.17	<1%
Administrators	0.30	<1%	0.30	<1%	0.30	<1%
Security and maintenance personnel	0.27	<1%	0.27	<1%	0.27	<1%
Antiretroviral therapy medications	144.26	31%	144.26	32%	144.26	33%
Viral load testing	260.17	56%	260.17	58%	260.17	59%
Cost to patient for transport to clinic visit	4.15	1%	3.81	1%	4.51	1%
Capital costs						
Office supplies and equipment	10.67	2%	10.67	2%	10.67	2%
Medical equipment						
Refrigerator	0.93	<1%	0.93	<1%	0.93	<1%
Weighing scale	0.08	<1%	0.08	<1%	0.08	<1%
Heightometer	0.12	<1%	0.12	<1%	0.12	<1%
Blood pressure machine	0.09	<1%	0.09	<1%	0.09	<1%
EPC intervention start-up costs, including personnel training	13.01	3%	13.01	3%	-	-
Indirect costs						
Opportunity costs						
Productivity loss from travel to clinic visit	10.85	2%	9.65	2%	11.58	3%
Productivity loss from time spent at clinic visit	4.43	1%	5.82	1%	7.41	2%
Total	462.57		452.25		443.71	

Note. All costs were aggregated across both clinics. Costs were collected in Kenyan shillings and converted to United States dollars using the 2019 international exchange rate.³³

EPC indicates enhanced patient care inclusive of provider-patient communications training and standard of care; PPC, provider-patient communication training inclusive of standard of care; SOC, standard of care only.

intervention to be costing more but generating less effectiveness relative to the PPC intervention and thus being identified as a dominated strategy. Further evaluation of EPC and PPC interventions relative to SOC showed that both intervention strategies were cost saving (ie, incremental intervention cost was less than estimated lifetime HIV treatment cost averted [$C < AT$]).⁴⁰ See Appendix 2 in Supplemental Materials found at <https://doi.org/10.1016/j.vhri.2025.101129> for an alternate calculation of incremental effectiveness in terms of additional transmission averted.

Sensitivity Analysis

Sensitivity analysis was conducted for key variables that we hypothesized to have the greatest influence on results. This analysis showed that varying key parameters using a deterministic (1-way) sensitivity analysis did not change the conclusions, with PPC found to be the most cost-effective intervention when compared with both EPC and to standard HIV care (Table 4). In addition, probabilistic analysis was completed to show the probability of the intervention being cost-effective when compared with standard HIV care services at different willingness-to-pay thresholds using a net monetary benefit calculation of willingness-to-pay times incremental effect (incremental number of patients virally suppressed compared with SOC) minus incremental cost ($WTP \times IE - IC$).⁴¹ The probability of the enhanced patient care intervention being cost-effective when compared with standard HIV

services was 100% at willingness-to-pay thresholds of 0.01 times and 0.5 times Kenya's per capita GDP (Fig. 1). The probability of PPC training being cost-effective when compared with standard HIV services was 100% at both willingness-to-pay thresholds of 0.01 times and 0.5 times Kenya's per capita GDP (Fig. 1).

Discussion

This economic evaluation used data from a randomized pilot trial to estimate the cost-effectiveness of a PCC model that includes clinic scheduling, provider-patient continuity, treatment dialogue, peer navigation, and PPC training to improve viral suppression among adults living with HIV in rural Kenya. The EPC intervention had a total annual cost of \$3908.48, with an average annual cost of \$462.57 per patient. Compared with SOC, the EPC intervention cost \$293.57 per HIV transmission averted, and the PPC intervention cost \$93.07 per HIV transmission averted. Providing a comprehensive EPC intervention or PPC training alone were both cost saving when compared with the lifetime HIV treatment costs associated with providing standard HIV care (\$13 192.50). In this analysis, providing PPC training as part of standard HIV services was more effective and less costly than providing the EPC intervention in addition to PPC training. However, the small sample size and short follow-up period may have influenced the

Table 3. Incremental costs, effects and cost-effectiveness ratios (2019 US\$).

Intervention variables and ratios	(1) EPC vs SOC	(2) PPC vs SOC	(3) EPC vs PPC
Incremental no. of patients virally suppressed (N)	13.35	19.00	(5.65)*
Incremental cost (C)	18.86	8.54	10.32
ICER (\$/patient virally suppressed) (C/N)	1.41	0.45	(1.83)*
ICER (\$/HIV transmission averted) (C/A)	307.10	97.72	(396.99)
ICER before considering lifetime HIV treatment costs (\$/DALY averted) (C/AD)	13.96	4.44	(18.04)
ICER considering lifetime HIV treatment costs (\$/DALY averted) (C-AT/AD)	(585.70)	(595.22)	(617.70)

Note. Outcomes and costs were aggregated across both clinics.

DALY indicates disability-adjusted life year; EPC, enhanced patient care inclusive of provider-patient communications training and standard of care; ICER, incremental cost-effectiveness ratio; PPC, provider-patient communication training inclusive of standard of care; SOC, standard of care only.

*Results suggest dominated strategy.

findings. It is possible that providing enhanced patient services in addition to PPC training may become more cost-effective than solely offer PPC training when delivered to a larger population, such as a crowded district hospital or emergency departments, over a longer (eg, >12 month) follow-up period.

There is a growing evidence base that PCC models are acceptable and effective for improving clinical outcomes among patients living with HIV in sub-Saharan Africa^{12,13,16,19,42}; but there remains almost no cost-effectiveness evidence to inform the wider adoption or sustainability of these models in generalized epidemic settings. One evaluation of an randomized controlled trial testing a task-shifted, cognitive behavioral therapy for PLWH with depression and virologic failure in South Africa found that the incremental cost of the patient-centered intervention, compared with usual treatment, was \$840 per quality-adjusted life year gained; this ICER was deemed cost-effective at less than $0.2 \times$ South Africa's gross domestic product at the time of the study⁴³ but was still more expensive than the ICER of \$13.96/DALY averted found in this evaluation of the EPC model. An analysis of South Africa's Simplifying TREATment and Monitoring (STREAM) trial found that a PCC intervention using decentralized point-of-care testing for ART monitoring—which decreased turn-around time for lab results and reduced loss to follow-up—was cost-effective in moderately sized clinics in South Africa; the intervention was no longer cost-effective when point-of-care testing did not lead to higher enrollment in

community ART delivery.⁴⁴ Economic analyses of PCC approaches to increase adherence to treatment-as-prevention in sub-Saharan Africa are similarly limited; those that are available rely on assumption-based modeling approaches⁴⁵ or solely estimate costs without measuring cost-effectiveness.⁴⁶ Furthermore, an analysis of home-based care and mobile clinics in Uganda, which aim to make care more convenient and time-saving for patients with HIV, were not found to be cost-effective compared with standard facility care.¹⁸ Thus this analysis helps to fill the evidence gap and advance our understanding of which patient-centered models are cost saving for HIV care systems in SSA.

Economic evidence of patient-centered care approaches among adults living with HIV is more readily available for high-income countries. These care approaches include patient data sharing between medical providers and pharmacists and collaborative therapy-related decision making,¹⁵ as well as bidirectional mobile health communication.⁴⁷ Although these models demonstrate cost-effectiveness and cost savings due to reduced HIV-associated morbidity and mortality, they are resource intensive and rely upon established infrastructure including the availability of multiple care providers and reliable electronic medical records systems. Thus, we remain limited in our ability to use the cost-effectiveness evidence of these models to inform decision making and program design in low- and middle-income countries where resources are scarcer.

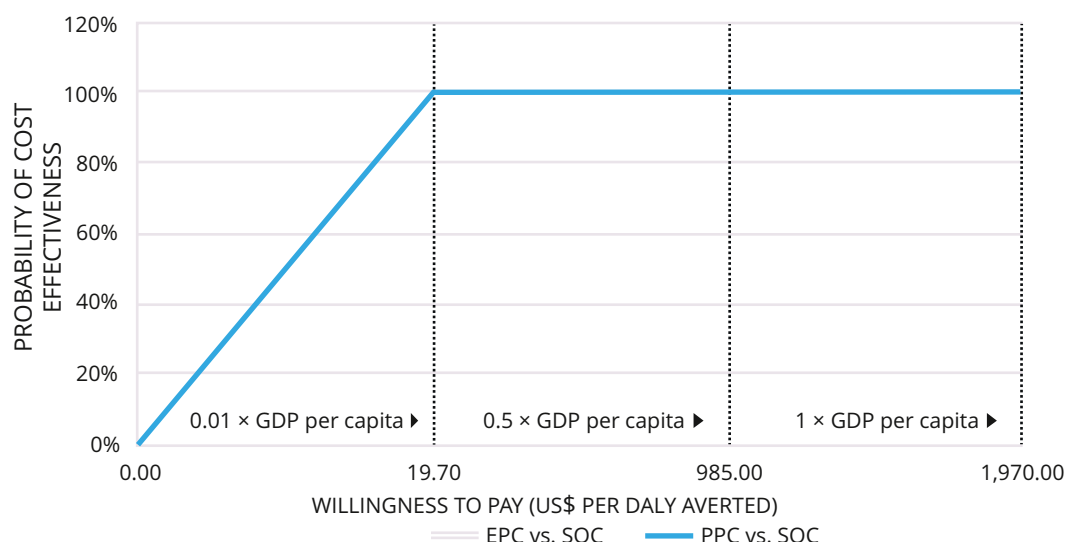
Table 4. Results for 1-way sensitivity analysis on ICER for EPC vs SOC and PPC vs SOC (2019 US\$).

Variable analyzed	Range in sensitivity analysis*	ICER (EPC vs SOC)	ICER (PPC vs SOC)
Base case	Not applicable	(585.70)	(595.22)
Antiretroviral treatment costs	(a) 108.20 (b) 198.36	(612.40) (545.66)	(613.97) (567.08)
EPC start-up costs	(a) 9.76 (b) 17.89	(588.11) (582.09)	(596.91) (592.68)
DALYs averted per HIV transmission averted (number of DALYs per infection averted)	(a) 16.50 (b) 30.25	(780.93) (425.96)	(793.62) (432.89)
Lifetime HIV treatment cost saved per transmission averted	(a) 9423.21 (b) 17 275.89	(435.79) (810.57)	(445.30) (820.09)
Incremental no. of patients virally suppressed (relative to SOC)	(a) 9.98 (b) 18.29	(581.05) (589.51)	(593.74) (596.43)

DALY indicates disability-adjusted life year; EPC, enhanced patient care inclusive of provider-patient communications training and standard of care; ICER, incremental cost-effectiveness ratio; PPC, provider-patient communication training inclusive of standard of care; SOC, standard of care only.

*Range parameter values used were (a) 25% decrease and (b) 25% increase per variable analyzed.

Figure 1. Probability the more effective care strategy is also more cost-effective than standard HIV care services at different willingness-to-pay thresholds.



DALY indicates disability-adjusted life year; EPC, enhanced patient care inclusive of provider-patient communications training and standard of care; GDP, gross domestic product; PPC, provider-patient communication training inclusive of standard of care; SOC, standard of care only.

There are some limitations to this analysis. First, the cost of treatment can vary between patients depending on the timing of treatment initiation, age, socioeconomic status, and drug regimen.^{16,48} However, this study only assessed aggregated costs and effects at the 2 study clinics, which may limit the generalizability of our findings beyond western Kenya. Second, as with most cost-effectiveness analyses, ours was based on several assumptions surrounding patients' average travel time to the clinic, amount of daily foregone wages when care seeking, and extrapolation of the number of observed 6-month visits to estimate full year of the intervention. Given the window of the intervention, we were not able to assess the impact of differentiated care on cost-effectiveness. Differentiated care, which is routinely implemented in these clinics, means that patients who are virally suppressed are only scheduled to come to the clinic every 6 months instead of every 3 months as required for unsuppressed patients. Future studies with longer observational time periods could assess whether patients with suppressed viral loads visit sites of care half as often as unsuppressed patients and any associated impacts on costs based on this outcome. Third, our effectiveness trial found that including provider-patient communication training as part of standard HIV care contributed to more patients being virally suppressed at 6 months (87 of 110 patients virally suppressed at 6 months in the PPC arm) than did providing the EPC intervention (81 patients virally suppressed in the EPC arm). These findings suggest that providing even select components of a comprehensive enhanced patient care package as part of routine HIV care could be cost saving. Although the results suggest that the EPC model is dominated by the more cost-effective intervention of providing PPC training alone, the effectiveness results are likely influenced by our small sample size. A larger, fully powered trial is needed to measure the extent to which offering the EPC intervention might demonstrate an economy of scale over time. Fourth, cost-effectiveness analysis can underestimate administrative costs that were already difficult to estimate because of data restrictions and unmeasured sources of confounding at the clinic level,¹³ such as behaviors and skills of personnel, the cultural and socioeconomic background of the patients, local and clinic-specific policies, and resource and infrastructure challenges. The influence of these factors

on incremental cost-effectiveness ratios should be addressed in future studies. Fifth, as mentioned, relying on GDP-based thresholds for cost-effectiveness are now discredited by many experts in favor of cost-effectiveness thresholds based on opportunity cost.³⁶ Given the very low ICER in our analysis, it does not rely on the typically high GDP per capita threshold and would still be considered cost-effective even when using more stringent assessments that account for opportunity costs. Last, we performed deterministic (one-way) sensitivity analyses only for select variables that we hypothesized to have the greatest influence on our ICERs. More rigorous probabilistic sensitivity analyses should be included in future studies of the EPC PCC model.

Despite these limitations, this evaluation is one of the first to quantify the cost and cost-effectiveness of an innovative patient-centered approach to promote HIV viral suppression among virally unsuppressed patients in sub-Saharan Africa. Findings from this randomized pilot trial can help decision makers assess which care approach can best address patient needs while offering the best value for money.

Conclusions

There is very limited economic evidence of effective PCC models in low- and middle-income countries. This analysis of a pilot randomized trial found that components of an inexpensive PCC model was cost-effective and cost saving for improving viral suppression among unsuppressed adult patients living with HIV in rural Kenya. A fully powered randomized trial is needed to inform longer-term adoption and sustainability of the innovative EPC model.

Author Disclosures

Author disclosure forms can be accessed below in the [Supplemental Material](#) section. The content of this work is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Supplemental Material

Supplementary data associated with this article can be found in the online version at <https://doi.org/10.1016/j.vhri.2025.101129>.

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