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How much does it cost to retain clients on antiretroviral treatment for one year in a large, public clinic? Routine financial costs of retention interventions at Lighthouse Trust in Lilongwe, Malawi

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Abstract

Introduction Poor retention (missed appointments or treatment discontinuation) on antiretroviral therapy (ART) may lead to disease progression, increased mortality, and HIV transmission. This study quantified the financial costs of implementing 12 months of routine services to improve ART retention at a large public clinic in Lilongwe, Malawi.

Methods We performed activity-based micro-costing from the payer perspective using routine program data to assess the costs associated with two retention interventions: ART treatment buddies (expert clients) and Back-to-Care (B2C) tracing services. New ART initiates receive a Buddy who provides proactive retention support for 12 months. B2C traces all clients who miss ART visits by ≥ 14 days. Costs were calculated as total and per-client expenditures, reported in 2021 USD.

Results The total cost for 12 months of ART retention activities was $237,564. Buddies accounted for $108,504, with personnel costs contributing $97,764. B2C totaled $129,060, with personnel expenses remaining substantial at $73,778. The unit costs were $34 per client Buddy and $17 per B2C tracing event.

Conclusion This study highlights the financial costs of delivering 12 months of ART retention services at a public, low-resource clinic. While proactive and reactive retention strategies are costly, both are essential for engaging ART clients from initiation onward.

Keywords Cost of routine health interventions, Activity-based costing, Retention in antiretroviral therapy care, Malawi, Patient tracing, Prevention of treatment interruption

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Introduction

High loss to follow-up (LTFU) [1], especially within the first year of antiretroviral therapy (ART) [2] reduces the impact of ART expansion. Newly initiated ART clients are particularly vulnerable to treatment interruptions [3, 4]. Although definitions vary [5], estimates of twelve-month retention on ART across sub-Saharan Africa (SSA) range between 76% and 94% [6–8], while 5-year retention falls to 66% across Africa [9]. Only a few studies explore the costs of retaining clients in routine ART care in low- and middle-income countries (LMICs) in SSA [10–14].

The Lighthouse Trust (LT), an ART Center of Excellence in Lilongwe, Malawi, with the Malawi Ministry of Health (MoH), operates the Martin Preuss Centre (MPC) to provide ART care to almost 25,000 clients on ART [15, 16]. Since 2006, MPC implemented a client retention program, "Back-to-Care" (B2C), that traces ART clients who miss a clinic visit by ≥ 14 days by phone or a home visit, playing a critical role in retaining LT clients in care [17–19]. B2C is reactive, intervening only after clients miss visits. To complement B2C, LT introduced a proactive retention support initiative that pairs all newly initiating ART clients with an Expert Client *ART Treatment Buddy*. Buddies are people living with HIV/AIDS (PLHIV) who serve as peer mentors and provide vital psychosocial support.

This cross-sectional, cost study aimed to improve understanding of the financial implications of routine proactive and reactive ART retention interventions during a 12-month period at the MPC clinic in Lilongwe, Malawi. The cost snapshot from the LT payer perspective may contribute to the broader discourse on retention activities and ART program sustainability.

Methods

Study setting

LT's MPC clinic is the largest public provider of ART services in Malawi. All LT client data, including at MPC, is managed in real-time using the Electronic Medical Records System (EMRS). ART clinic visits for new ART initiates are scheduled monthly during the first six months and then every three or six months, similar to ongoing ART clients, if the client is stable and ART adherent. All clients receive routine adherence counseling at each visit by nurses or psychosocial support providers, if warranted. Phone numbers and address details for tracing are collected on the B2C form at ART initiation. As an indication of MPC client volume, between April and June 2023, of 18,842 scheduled ART visits, 1798 (~ 10%) missed visits by ≥ 14 days and were referred to B2C.

LT's predominant client retention activities

Proactive efforts before a visit or within 13 days of missed visits: the ART Buddy program

New ART clients receive intensified, proactive retention support from a PLHIV, Expert Client "buddy" during the first 12 months in care, only. Each Buddy supports ~ 15 new ART clients. All new ART clients are expected to have a 1-to-1 counseling session with their assigned Buddy at ART initiation and meet with them during subsequent visits as needed. Buddies call clients to remind them of scheduled ART visits and, if needed, call during the first 1–13 days after a missed visit, trying to return clients to care. Buddies update B2C locator forms for clients who change contact information.Buddies refer clients to B2C if they miss visits by ≥ 14 days.

Reactive retention efforts after a missed visit ≥ 14 days: back-to-care (B2C)

Following MoH policy, all clients are eligible to be traced after missing a visit by ≥ 14 days at any point on their ART care timeline [17]. EMRS is used to identify and refer potential LTFU clients to a dedicated team of B2C tracers who attempt to reach clients first by up to five attempts by phone, and then by up to three home visits if calls fail. When clients are successfully reached, B2C tracers encourage those who have missed appointments to return to care. Clients have only one tracing event per visit but may have multiple B2C tracing events per year.

Costing approach

We applied the Global Health Cost Consortium Reference Case guidelines [20] to perform activity-based micro-costing from the payer perspective (LT). We assess the expenses incurred from the routine implementation of the two predominant retention activities (Buddy and B2C) over 12 months, January to December 2021, for new and continuing ART clients at MPC.

Data collection

We collected cost data from multiple sources, including MPC expenditure records, payroll, procurement documents, and routine program data. These data were categorized into two main groups: fixed and variable costs (Table 1). Fixed costs, incurred only once during the intervention, included initial training of retention personnel, a one-time motorcycle insurance premium, cellular airtime bundles, and the procurement of office equipment and motorcycles. Variable costs, which sustained the intervention over time, encompassed personnel costs, communication expenses for reaching and following up with ART clients, general office supplies, motorcycle maintenance, fuel, protective gear for motorcycle riders, and overhead costs representing opportunity costs. The financial costs accounted for the direct

Table 1 Cost categories

Inputs	Cost category	Description
Personnel	Variable	Covers personnel salaries, benefits, and the time and effort invested in retention activities.
Communication	Variable	Expenses related to phone services from various companies.
Protective gear	Variable	Gear for motorcycles, such as helmets and other safety equipment.
Fuel	Variable	Fuel costs associated with the motorcycles used for B2C retention efforts.
Maintenance	Variable	Expenses incurred in maintaining the motorcycles.
General supplies	Variable	Supplies used for documentation and communication with clients.
Overhead	Variable	The costs related to utilities and building maintenance.
Equipment	Fixed	Investments that have a lifespan exceeding one year, including mobile phones, desktops, furniture, and motorcycles.
Training	Fixed	Startup expenses are allocated for training staff in client retention strategies.

Table 2 Activity and input cost of ART retention care at the MPC in 2021 (USD)

Intervention	Cost category	Total cost	% of total cost
Proactive: ART Buddy			
	Training	$6,592	6%
	Equipment	$3,055	3%
	Personnel	$93,764	86%
	Protective gear	$3,055	3%
	Supplies	$1,689	1.5%
	Communication	$349	0.5%
Total Buddy intervention costs		$108,504	100%
Reactive: B2C			
	Equipment	$12,853	10%
	Training	$3,636	3%
	Personnel	$73,778	57%
	Overhead	$12,518	10%
	Fuel	$10,427	8%
	Protective gear	$7,422	5%
	Maintenance	$3,685	3%
	Communication	$1,018	1%
Total B2C intervention costs		$129,060	100%
Overall, ART retention costs		$237,564	

expenses incurred in retaining new and existing ART clients, while the economic costs took into consideration the opportunity costs linked to shared costs. Shared costs, which are not directly attributable only to ART retention activities—such as administrative expenses, utilities, and facility maintenance—were allocated to the retention activities based on the proportion of staff time dedicated to ART retention relative to their time on the general clinic operations.

Since the perspective of the analysis was from the LT organizational perspective (payer), we excluded costs not incurred by the clinic, such as ART medication costs (paid by the government), research personnel specific to this study but not routine program implementation, and client-incurred expenses like transportation costs and time lost from work. These exclusions align with our focus on costs borne directly by the clinic in providing ART retention services.

Data analysis

Analyses were conducted using Microsoft Excel (version 16.76; Microsoft, Redmond, WA). All retention costs over the 12 months were collected in Malawian Kwacha (MWK) and converted to United States Dollars (USD) using the annual average exchange rate for 2021, which was 1 USD = 825 MWK. This average rate accounts for exchange rate fluctuations throughout 2021 and provides a consistent basis for our cost analysis.

Equipment costs were calculated using a 3% discount rate over 5 years. To determine the unit cost of the proactive Buddy intervention for new initiates, we divided the total expenses incurred during the first 13 days after a missed visit by the number of new initiates in 2021. The unit cost for the reactive B2C intervention, available for all clients, was calculated by dividing the total expenses incurred for ART retention beyond the initial 13-day period by the number of tracing events among new and continuing clients.

A univariate sensitivity analysis was conducted to assess the impact of changes in personnel costs on both proactive and reactive retention activities. Specifically, we evaluated the effect of a 25% increase in personnel costs on the total and unit costs of both the Buddy and B2C interventions.

Results

In 2021 at MPC, there were 24,863 clients on ART care who were eligible for B2C tracing, including 3,280 new ART initiates who were also eligible for Buddy proactive retention support during their first 12 months in care. Among all MPC clients, there were 7,588 tracing events in 2021.

Retention costs for Buddy and B2C activities

The total cost of retention interventions for 12 months at MPC was $237,564 (Table 2). The proactive Buddy phase, only for new ART initiates, incurred a total cost of $108,504, with personnel costs being the highest at $97,764, followed by training expenses at $6,592. In the reactive B2C phase, for all clients, the total cost was $129,060, with personnel costs remaining significant at

$73,778. Overhead, fuel and vehicle expenses also contributed notably, amounting to approximately $12,518, $10,427, and $9,105, respectively.

Retention cost categories

For Buddies, the overall cost was $108,504 (Table 3). Fixed (start-up) costs amounted to $9,647, representing 9% of the total cost, while variable (recurrent) costs were significantly higher at $98,587, accounting for 91% of the total cost. In contrast, the total cost of B2C was $129,060, with higher start-up costs of $16,757, comprising 13% of the total, and recurrent costs of $112,303, making up 87% of the total.

Per client unit cost

The unit cost of proactive Buddy support for ART retention at MPC for 3,280 new clients was $34 (Table 4). B2C, with 7,588 tracing events, yielded a unit cost of $17.

Cost drivers

In the proactive Buddy intervention (Fig. 1), personnel costs accounted for the largest share at 86% of total expenses, while training and protective gear costs contributed 6% and 3%, respectively. In the reactive B2C intervention (Fig. 2), personnel costs remained significant at 57%, though lower compared to the Buddy intervention. Overhead and equipment costs each accounted for 10%, followed by fuel at 8% and protective gear at 6%.

Table 3 Fixed vs. variable cost of ART retention care at the MPC in 2021 (USD)

Intervention	Cost category	Total cost	%of total
Proactive: ART Buddy	Fixed (Startup)	$9,647	9%
	Variable (Recurrent)	$98,587	91%
	Total	$108,504	100%
Reactive: B2C	Fixed (startup)	$16,757	13%
	Variable (Recurrent)	112,303	87%
	Total	129,060	100%
Total		$237,564	

Table 4 Unit cost of ART retention care at the MPC in 2021 (USD)

Intervention	Total cost	Number of clients /Tracing event/	Unit cost
Proactive Buddy	$108,504	3,280*	$34
Reactive B2C	$129,060	7,588**	$17

* Number of new ART clients in 2021, ** Number of tracing events

Sensitivity analysis

With a 25% increase in personnel costs, the total cost of the proactive Buddy intervention rose from $108,000 to

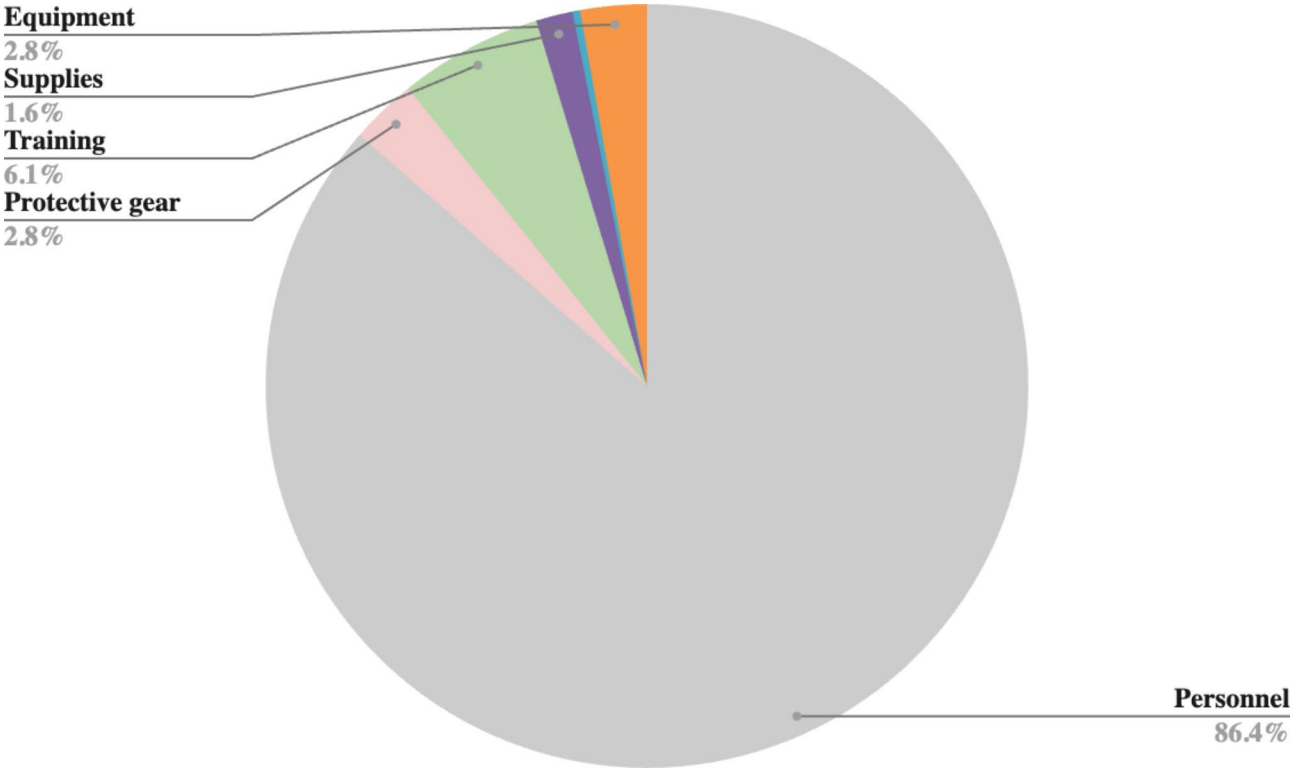

Fig. 1 Cost drivers for proactive ART retention intervention: Buddies

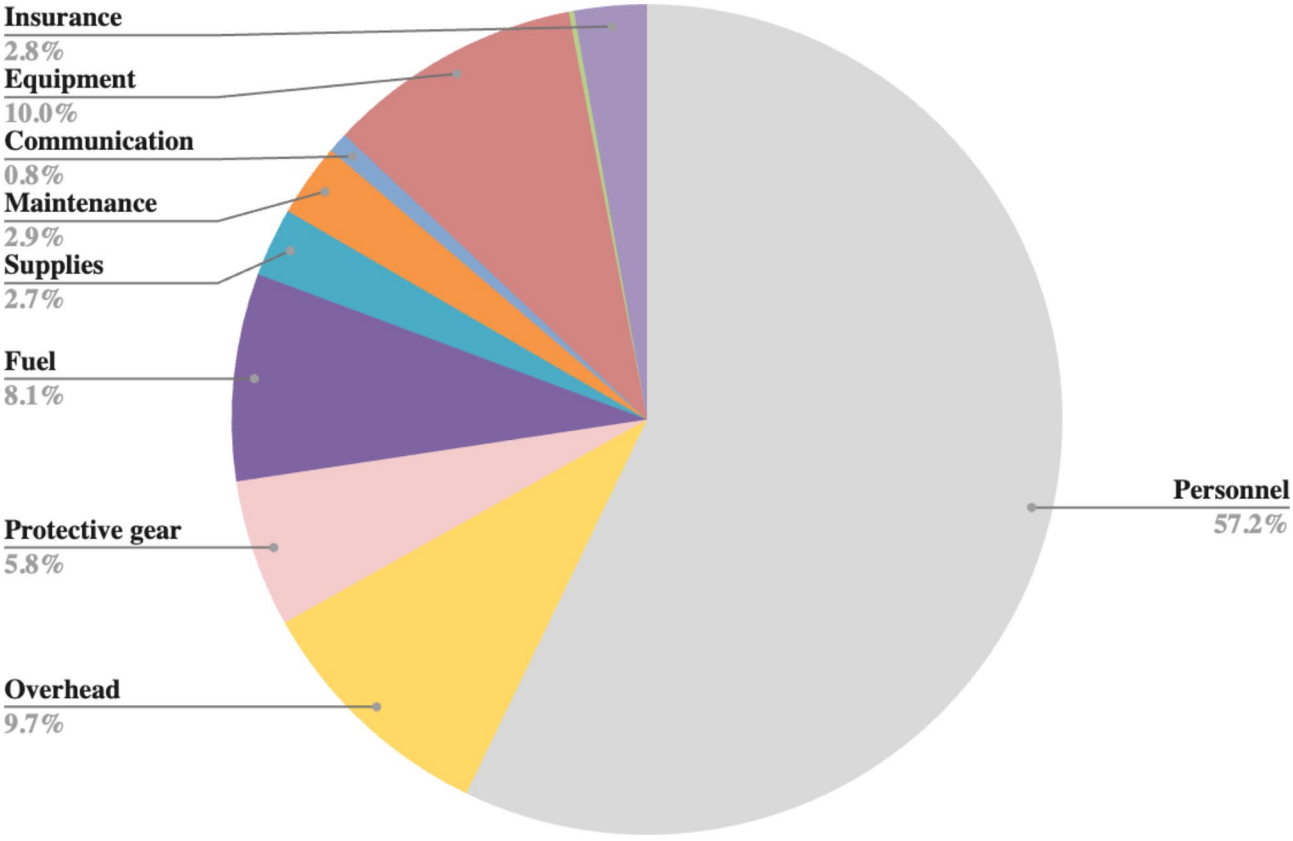

Fig. 2 Cost drivers for reactive ART retention intervention: B2C

$136,000, with the unit cost increasing by 27%, from $33 to $42. Similarly, the total cost of the B2C intervention increased from $129,000 to $147,000, resulting in a 12% increase in the per-tracing cost, from $17 to $19.

Discussion

This study provides a snapshot of the routine, payer-perspective costs for MPC's predominant retention activities, the proactive Buddy program for new ART initiates, and the reactive ART tracing program, B2C, for all clients, over 12 months. The proactive Buddy program incurred a total cost of $108,504, with personnel costs being the largest contributor. The reactive B2C program had a total cost of $129,060, where personnel expenses were also significant. However, overhead, fuel, and vehicle costs contributed notably, highlighting the diverse expense profile of the program. While some complementary retention activities may be missing, this study suggests the key cost drivers across the continuum of retention interventions, offering valuable insights for LMIC policymakers and healthcare administrators when considering retention service allocations and program planning.

The unit cost analysis provides valuable insights into the key resources needed to maintain retention interventions. For the proactive Buddy retention program, the unit cost per client (covering 3,280 new clients) was $34, while the reactive B2C program had a lower unit cost of $17 per tracing event (involving 7,588 tracing episodes). Early retention efforts, such as the Buddy program, likely reduce the likelihood of missed visits, adding value to the investment. Additionally, the $17 per tracing event represents a low cost to attempt to re-engage clients, supporting the case for continued investment in B2C. Although further investigations are required to understand retention patterns to identify which clients or client groups may require more retention resources, it appears that a combined proactive and reactive retention approach may be an efficient strategy.

Lower reported retention costs at MPC should not overshadow pervasive and persistent funding gaps that likely reduce Buddy or B2C effectiveness. MPC's annual retention costs appear far lower than a modeling study that reported $93 to $6518/client [21] and a community-based tracing model in Tanzania with reported costs of $47.56 and $206.77 to trace or return a client to care, respectively [22]. Lower retention costs at MPC may reflect improved efficiency due to the maturity of the B2C model or the reliance on low-cost Expert Client Buddies, but it could also signal program weaknesses requiring

additional funding. For instance, Buddies only supports clients during their first year, leaving gaps in addressing long-term retention support. Moreover, additional resources are necessary to maintain accurate location information, which often changes due to client mobility. Finally, gaps in B2C will likely grow as funds decrease [23]. Proactive targeted retention interventions should be considered. Previous studies note that retention is not a stagnant state and that retention patterns differ by client characteristic [24–28], calling on future studies to identify which patients are most at risk of LTFU. Identifying complementary, lower-cost, retention interventions, such as MPC's Two way Texting (2wT) approach [29, 30], or using advanced techniques like machine learning to identify which patients are most at risk of LTFU for better-targeted retention interventions, could help reduce retention costs.

Limitations

First, budget constraints for this small costing activity led to a reliance on secondary data and aggregate costs. Personnel costs for these retention activities may have been misestimated, as some retention staff were engaged in non-retention tasks, while non-retention staff may have contributed to retention-related support. In future studies, conducting a time-in-motion analysis across all retention activities would add rigor and enhance results. Additionally, Lighthouse Trust, including MPC, is a Centre of Excellence in urban Lilongwe with highly motivated and skilled staff; therefore, retention costs at MPC may not be generalizable to ART clinics in rural areas or other LMICs. As this study represents a costing snapshot rather than a cohort study, we assumed uniform client engagement, potentially overlooking retention variations that could influence unit costs, and included clients who were not observed for the full 12 months. The importance of client-side costs, such as transportation and opportunity costs, were excluded, but well considered previously [31, 32]. Lastly, while we conducted sensitivity analyses, the 2021 cost data may underestimate costs in 2024.

Conclusion

This study provides valuable insights into the financial aspects of ART retention interventions for a 12-month period at MPC, a public clinic in Lilongwe, Malawi, suggesting that personnel largely drives retention program costs. While the per-person Buddy and B2C tracing costs are low, these numbers do not reflect the full continuum of retention support. In consideration of reduced global funding and ever-increasing ART cohorts, focusing limited retention resources on clients at the highest risk of LTFU may be advantageous at LT and in other LMIC ART settings.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s13104-024-07077-z.

Supplementary Material 1

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Author contributions

HW, AT, CF: Writing – original draft. HW: Formal Analysis. AT, CKK, JH: Investigation and Project Administration. CKK, HT, MC: Data curation. HW, CKK, AT, HT, and CF: Conceptualization. All authors: Writing – review & editing.

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Data availability

The full data set used for this costing study is included as supplementary material.

Declarations

Ethics approval and consent to participate

This costing study involved no human subjects nor identifiable data and was conducted as part of a larger study on innovation to improve client retention using two-way texting (2wT). Only aggregate-level, routine, de-identified data was used for retention estimates across periods and retention activities. The broader 2wT study protocol, including cost analysis, was approved by the Malawi National Health Sciences Research Committee (#20/06/2565) and the University of Washington, Seattle, USA, ethics review board (STUDY00010106).

Consent for publication

Not applicable: no identifiable data present.

Competing interests

The authors declare no competing interests.

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