

Integration of HIV and NCD Service Provision: Cost Savings and Implications in Nakuru County, Kenya

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Abstract Background: Dwindling donor funding has been on the rise. Therefore healthcare systems are forced to strategize on how to manage their service delivery with the available resources. There is need to sustain the healthcare services delivery. Integration of Human Immunodeficiency Virus (HIV) and (Non-Communicable Diseases) NCDs services has emerged as a potential solution to improve patient outcomes and optimize resource utilization. This study aimed to evaluate the cost savings associated with integrating HIV services with three common NCDs: Diabetes Mellitus (DM), hypertension (HTN), and the combination of diabetes and hypertension (DM/HTN) in Nakuru County. **Methods:** This study utilized a hybrid costing approach that combined both top-down and ingredients approaches. The costing analysis took a health system perspective and for acute conditions, the time horizon considered was a case management episode. To determine cost savings, integrated service costs were subtracted from the cumulative costs of individual services on a per-case basis. **Results:** Integration of HIV and diabetes services resulted in annual cost savings of KES 7,086 (21%) per case. Similarly, integrating HIV with hypertension services yielded cost savings of KES 6,166 (19%) per case. The greatest cost savings were observed when integrating HIV with both diabetes and hypertension services, with annual savings of KES 10,653 (29%) per case. **Conclusion:** The study results prove that integrating HIV/NCD services would save the healthcare system costs incurred while delivering the services in a parallel model. Hence recommends that healthcare service delivery be supported using an integrated care model to enhance sustainability of the services that have been heavily funded by donors in this country.

Keywords HIV/NCDs, Cost savings, Integration, Kenya, Costing, and Process map

1. Introduction

Kenya's recent reclassification as a lower middle-income country (LMIC) has significant implications for its eligibility for development assistance. As some donors begin to transition out, it is crucial to manage this transition effectively to prevent a reversal of the health gains achieved. To address this challenge, a reprogramming of health services is necessary, shifting from parallel disease programs to integrated health services and emphasizing preventive care through publicly funded primary healthcare. Integrating HIV and non-communicable disease (NCD) programs can generate cost savings that can be redirected towards strengthening healthcare systems, expanding access to care, and improving overall population health.

In Sub-Saharan Africa (SSA), non-communicable diseases (NCDs) such as diabetes, neoplasms, cardiovascular diseases,

and mental illnesses are prevalent among individuals living with HIV (HIV-positive people). The presence of these NCDs poses a significant threat to the progress made in HIV treatment programs. They not only contribute to increased impairment and mortality rates among HIV-positive individuals in SSA but also present additional challenges in providing comprehensive healthcare for this population [1]. People living with HIV (PLWHIV) are more susceptible to non-communicable diseases (NCDs) due to several factors. The inflammatory markers that are stimulated by HIV infection, as well as the potential adverse effects associated with antiretroviral therapy, contribute to this increased risk. Additionally, behaviors such as tobacco smoking, alcoholism, unhealthy diet, and physical inactivity further exacerbate the likelihood of acquiring NCDs among individuals with HIV. It is important to address these risk factors and promote healthy lifestyles to minimize the burden of NCDs in this population. [2]. High viral suppression and increased life expectancy among PLWHIV, and the expanded access to care also increase the window period for NCDs to progress as PLWHIV ages [3]. Elevated

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hypertension prevalence in PLWHIV is attributed to persistent inflammation, heightened microbial translocation and renal illness, blood vessel injury from constant ART exposure, and behavioral risk factors among PLWHIV [4]. Additionally, HIV-positive women are predisposed to infection with human papillomavirus (HPV), pre-cancer, and invasive cervical cancer somewhat due to HIV's modifying effect on HPV pathogenesis [5].

According to the Ministry of Health in Kenya (MoH, 2021), NCDs accounted for over 50% of in-patient cases and 40% of hospital mortalities reported in Kenyan hospitals. It is worth noting that HIV services in the country are separate and operate independently. These services are delivered in a vertical manner, meaning they have a distinct focus, and they are decentralized and implemented through task shifting to effectively treat a large number of patients. [6]. Globally, the recognition of the impact of comorbidity between HIV and Non-Communicable Diseases (NCDs) has grown, revealing the complex nature of managing these conditions and the challenges they pose to the healthcare system, patients, and caregivers. The achievements in combating HIV/AIDS are hindered by the increasing prevalence of NCDs among individuals living with HIV (PLWHIV). This comorbidity not only affects the cost of care, diagnosis, and health outcomes for PLWHIV but also presents additional obstacles in their overall treatment and management. [7]. Integrating these two services will improve efficiency and enhance the utilization of NCD services [8].

Integrating HIV/NCD services in health facilities is a crucial step towards improving the overall health outcomes and well-being of individuals living with HIV/AIDS. Integrating HIV/NCD services also aligns with the global health agenda of achieving universal health coverage (UHC). UHC aims to provide all individuals and communities with access to quality healthcare services without financial hardship [9]. By integrating services, health systems can deliver a comprehensive package of care that encompasses prevention, diagnosis, treatment, and long-term management of both HIV and NCDs. This approach promotes equity in healthcare provision and helps to bridge the gap between HIV and NCD services, ensuring that no individual is left behind in accessing essential healthcare. Moreover, integrating HIV/NCD services optimizes the utilization of resources and healthcare infrastructure. Combining services for HIV and NCDs in the same facility allows for shared resources, including laboratory tests, diagnostic equipment, and healthcare personnel.

This approach enhances efficiency, reduces duplication of efforts, and improves cost-effectiveness in healthcare delivery. Additionally, integrated care models promote early detection, prevention, and management of NCDs among PLWHIV, resulting in improved health outcomes, and reduced long-term treatment expenses. By combining efforts, HIV/NCD integration not only improves patient care but also maximizes cost-effectiveness, making it a sustainable and

efficient approach to healthcare delivery [10].

Cost savings are a compelling driver for the integration of HIV and non-communicable disease (NCD) services. Estimating and understanding the potential cost savings associated with integration is important for several reasons. Firstly, healthcare systems worldwide face financial constraints and limited resources. By integrating HIV and NCD services, synergies can be achieved, leading to more efficient use of available resources. Estimating cost savings helps healthcare policymakers and administrators make informed decisions about resource allocation, budgeting, and planning. It provides them with evidence to advocate for the integration of services and secure necessary funding. Secondly, cost savings are crucial for sustainability. By optimizing resource utilization, integration can help mitigate the financial burden on healthcare systems. This is particularly relevant in low- and middle-income countries, where resources are often scarce, and the prevalence of both HIV and NCDs is high. Estimating cost savings helps ensure the long-term viability and scalability of integrated programs, as it demonstrates the potential return on investment and the financial benefits of integration.

Furthermore, estimating cost savings provides a framework for evaluating the economic impact and cost-effectiveness of integrated HIV/NCD services. It allows for comparisons with alternative approaches or interventions, helping policymakers prioritize resource allocation based on the potential benefits and efficiency gains. Cost-effectiveness analyses can inform decision-making by identifying the most economically viable strategies for improving health outcomes and reducing the burden of disease. Estimating cost savings also contributes to advocacy efforts. It provides tangible evidence that integration is not only beneficial from a health perspective but also economically advantageous. This evidence can be used to garner support from stakeholders, policymakers, and funders who may be more inclined to invest in integrated programs if they can see the potential financial gains.

Additionally, estimating cost savings helps identify areas where efficiencies can be maximized. By understanding the specific cost drivers and potential savings, healthcare systems can implement strategies to optimize service delivery, streamline processes, and eliminate redundancies. This continuous improvement can lead to ongoing cost savings and resource optimization in the long-run. Therefore, it is imperative to investigate and quantify the potential cost savings associated with HIV/NCD integration. Such investigations will provide valuable insights for policy decisions, resource allocation, and the development of sustainable healthcare approaches in the face of changing funding dynamics. As such this study aimed to evaluate the cost savings associated with integrating HIV services with three common NCDs: diabetes (DM), hypertension (HTN), and the combination of diabetes and hypertension (DM/HTN) in Nakuru County.

2. Methodology

Study area

This study was conducted in 31 health facilities in Nakuru County in Kenya.

Costing design

The Time Driven Activity Based Costing (TDABC) approach was utilized [11,12]. TDABC is a methodology that assigns costs to inputs and services, primarily serving as a tool for planning and control. While direct labor and materials can be easily linked to specific products, allocating indirect costs to different key result areas poses a greater challenge. In cases where inputs are shared among multiple activities, a weighting system is necessary for cost allocation. The goal of this process is to allocate costs based on each intervention and activity to achieve predetermined goals or results. By identifying the factors that cause cost fluctuations (cost drivers), the TDABC approach traces and assigns all activity costs to the corresponding intervention or service. In this study, TDABC was applied to HIV and NCD services. Normative costs were employed, representing the costs expected to be incurred when approved standard clinical guidelines are followed for case management.

This study also adopted a hybrid approach to costing that combined top-down and an ingredients approach. This approach is common and takes advantage of the strengths of each method while completing either methods weakness. The top-down approach was used to measure and allocate shared costs to specific services. These include health facility administration and overhead costs that include management and operations, staff salaries, electricity, water etc. The top-down approach used retrospective data of healthcare expenditures and divided total expenditure by the services provided in the given period. The study used an ingredients approach to measure direct costs to specific health services. These included costs of diagnostics, medicines, and other consumables etc. While an ingredients approach allows much greater disaggregation of the cost data and tends to be more accurate, it is more time-consuming.

Estimation methods

The TD-ABC methodology follows a seven-step approach as follows.

Step 1: Select medical condition and/or patient population: ABC focused on all priority services.

Step 2: Define the care delivery value chain: The care delivery value chain (CDVC) charts out the main activities involved in the patient's full care visit. CDVC is both a descriptive and prescriptive tool that maps the full set of activities delivered over the care visit, spanning multiple providers and nonclinical settings, and offers providers a systematic approach to analyze, improve, and implement new configurations of care if needed. This is the starting point for producing a process map for each intervention. Use of patient treatment guidelines and expert opinions was used to provide a simple map of the CDVC for when and where

health services are provided and what activities are performed at each stage of the CDVC and by whom.

Step 3: Develop process maps of each activity in the patient care visit to identify the resources involved and any supplies used for the patient at each process: Process maps are developed for each activity in the care delivery value chain and consists of the path that a patient may follow to receive care (care visit). The process map included the resources (personnel, facilities, and equipment) involved in each process used by the patient or needed to make the primary resources available. This includes commodities and consumables such as drugs and pharmaceutical supplies used for direct service delivery.

Step 4: Obtain time estimates for each process step: How much time a provider spends with a patient or how much time a piece of equipment or other resources are used for each process step. The data on time was sourced from the existing literature as well as experts' opinion.

Obtain workload/norms and standards estimates for each process step: Estimate how much investment / depreciation/workload a piece of equipment, Human Resources for Health (HRH) and other resources are used for each process step need to be measured by extracting data from the relevant sources and experts opinion where necessary

Step 5: Estimate the cost of supplying patient care resources: The costs of all inputs used to provide the needed patient care was estimated. This included both direct and indirect costs. Direct costs include staff compensation, depreciation or leasing of equipment, and supplies. This data was collected from relevant sources. Indirect costs include support staff and other operating expenses needed to provide services. These include the costs of utilities, infrastructure, etc.

Information on equipment, room dimensions, and administrative staffing required to estimate the full cost of providing the service. An equipment, furniture, and space data collection tool was used to gather data on equipment and general supplies.

Step 6: Estimate the capacity of each resource; This consisted of estimating the capacity cost rate for personnel, equipment, and space. Data on the annual cost of each resource were obtained and divided by how often, in minutes, the resource could be used annually. This is the hypothetical cost if resources are used at their capacity.

TDABC was used to capture costs for (a) care and treatment provided at the facility level, (b) diagnosis and treatment provided to HIV and NCD patients at the facility level, (c) routine outpatient services provided at the facility level. Overall, TDABC identifies and measures the following:

Activities: Those that are performed over the care visit for a condition, who performs each activity, and how long they spend on each activity.

People, furniture, equipment, and facility space: Cost per unit of time for each type of personnel, furniture, equipment, and facility space used during the care visit

(capacity cost rate).

Materials: Those that are consumed during the care visit (supplies/consumables, drugs, lab tests and reagents, test kits, etc.).

On-site indirect cost: Additional costs incurred that are not directly consumed over the care visit. These are costs that do not directly contribute to individual patient care but are expended for service provision to be made possible, such as salaries of administrators, cleaners, security personnel, and utilities such as heating and electricity.

Step 7: Calculate the unit cost per intervention: This final step consists of estimating the unit cost of each health service provided. A unit cost calculation was possible for every health intervention that has a process map developed. This is done by multiplying the capacity cost rates for each resource used in each patient process by the amount of time the patient spent with the resource (Step 4). Then, all the costs were summed up across all processes used during the patient's complete visit to the facility for the estimated total costs of the patient visit.

Costing Data

Data on costs was collected from various sources within the facility. Specifically, the cost data for the human resources required for HIV/NCD services was extracted from the Ministry of Health Staffing Norms and Standards, which are outlined in the Ministry of Health's guidelines for the health sector called "Human Resources for Health Norms and Standards Guidelines." To estimate costs for recurrent goods and services, we referred to expenditure records [13,14]. In order to validate the list of recurrent items and services, determine the quantity of units used, and allocate items across different functions and time periods, interviews were conducted with staff members. The costs of capital goods were discounted at a rate of 3% annually. Consultative meetings were also held to refine the activities and establish the implementation plan for each activity.

The study made several major assumptions including:

- i. Facility indirect capacity cost rates (CCR) were determined based on the assumption that the duration of an average outpatient visit would be the same as an average disease area-specific facility visit.
- ii. The cost of most pharmaceutical and laboratory consumables, except for antiretroviral drugs (ARVs), was estimated using the 2021 sales price from the Kenya Medical Supplies Authority (KEMSA) as the reference unit price. The study assumed that the actual price of general clinical and administrative consumables, as well as laboratory test kits and consumables, would be similar to the KEMSA sales price.
- iii. The initial calculations of facility room CCR were based on the inventory of furniture and equipment collected. It was found that most rooms had a CCR of less than USD 0.01. The study assumed that all facility locations, except for laboratories and pharmacies, would have a CCR of USD 0.004 per minute. On-site pharmacies and laboratories in Level 4 and 5 facilities

were assumed to have a CCR of USD 0.01 per minute. We assumed that all facility locations, except for labs and pharmacies, would have a CCR of USD 0.004 per minute. We assumed that on-site pharmacies and laboratories in Level 4 and 5 facilities would have a CCR of USD 0.01 per minute. These estimates are based on the study team's observation that most rooms would need to have an annual cost of USD 650 to have a CCR above USD 0.005. This would require multiple equipment with replacement costs over one-thousand US dollars, which are more often observed in laboratories and pharmacies in referral or higher-level hospitals.

- iv. In estimating annualized cost per ART client, the study assumed an average of seven facility visits per year for a stable client and ten visits per year for an unstable client. These are the frequencies of visits indicated by the amount of ARV dispensed to the clients observed in our client shadowing process.

An excel-based data tool was used to capture specific inputs needed for HIV/NCD services, including the data from past health system and facility assessments. All costs reported are in 2021 U.S. dollars. Data analysis was conducted using an Excel-based tool that had the provision for activity/sub-activity, costing assumptions, inputs specification, input price, frequency of occurrence, recurrence of the activity, and total cost of the activity.

3. Results

The presented process maps offer a comprehensive outline of the essential stages encompassed in the delivery of HIV and NCD services, including the processes of identification, screening, ongoing care, and prevention. These maps serve to illustrate the sequential nature of care provision, the time allocation for each step during a care visit, the healthcare professionals involved, and the service location. By examining the process maps, it becomes evident that there are variations in the delivery of care both among different facilities and within the same facility. Additionally, the process maps shed light on the fact that providers' perceptions of the care process often deviate from the recommended clinical protocols outlined in Kenya's national guidelines. See figure 1.

There is minimal disparity in the care processes for stable and unstable clients, with only slight distinctions noted. However, in the study sample, the average provider-patient contact time for adult unstable clients surpasses that of adult stable clients. It is important to note that Kenya's treatment guideline for HIV recommends additional adherence and nutritional counseling support specifically for unstable clients. Regrettably, these additional support measures are only observed in a portion of the unstable clients, indicating inconsistencies in adherence to the recommended guidelines.

Interestingly, little difference is observed between care processes for stable versus unstable clients, although average

provider-patient contact time for adult unstable clients is higher than that for adult stable clients in the study sample. Kenya's treatment guideline for HIV recommends additional

adherence and nutritional counselling support for unstable clients, but these are only observed in some of the unstable clients.

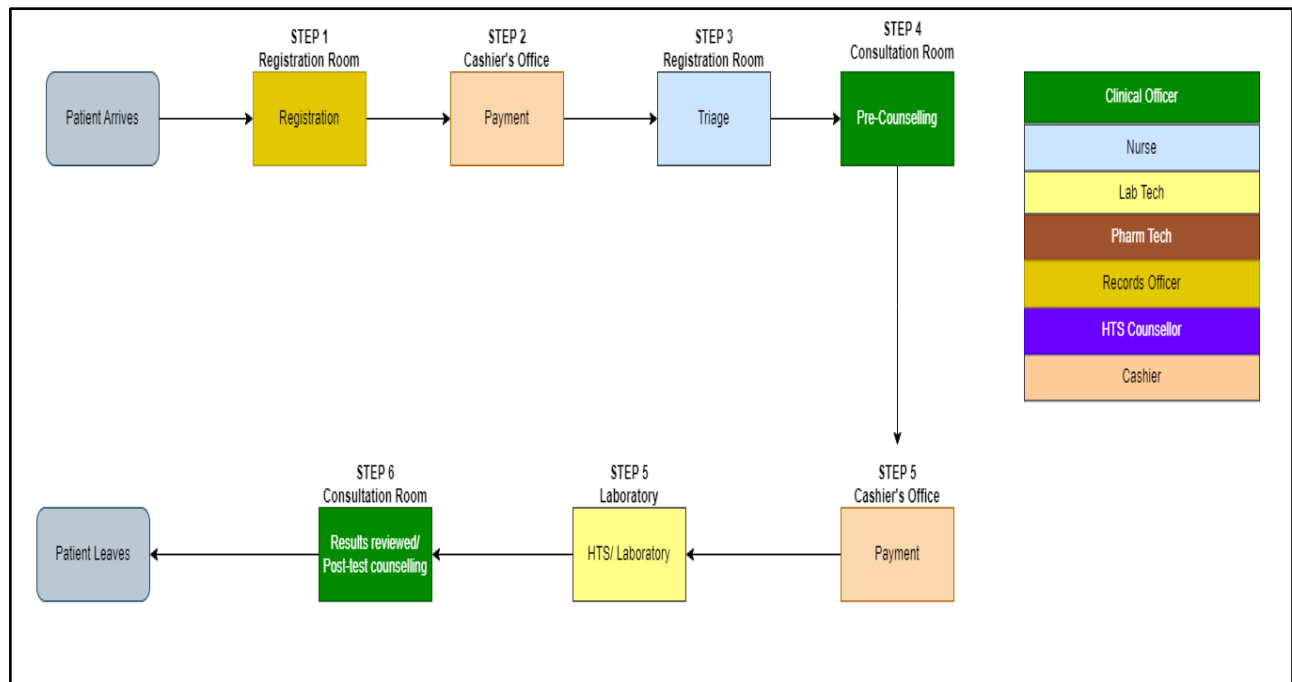


Figure 1. Process Map of HIV Screening (Source: Author, 2023)

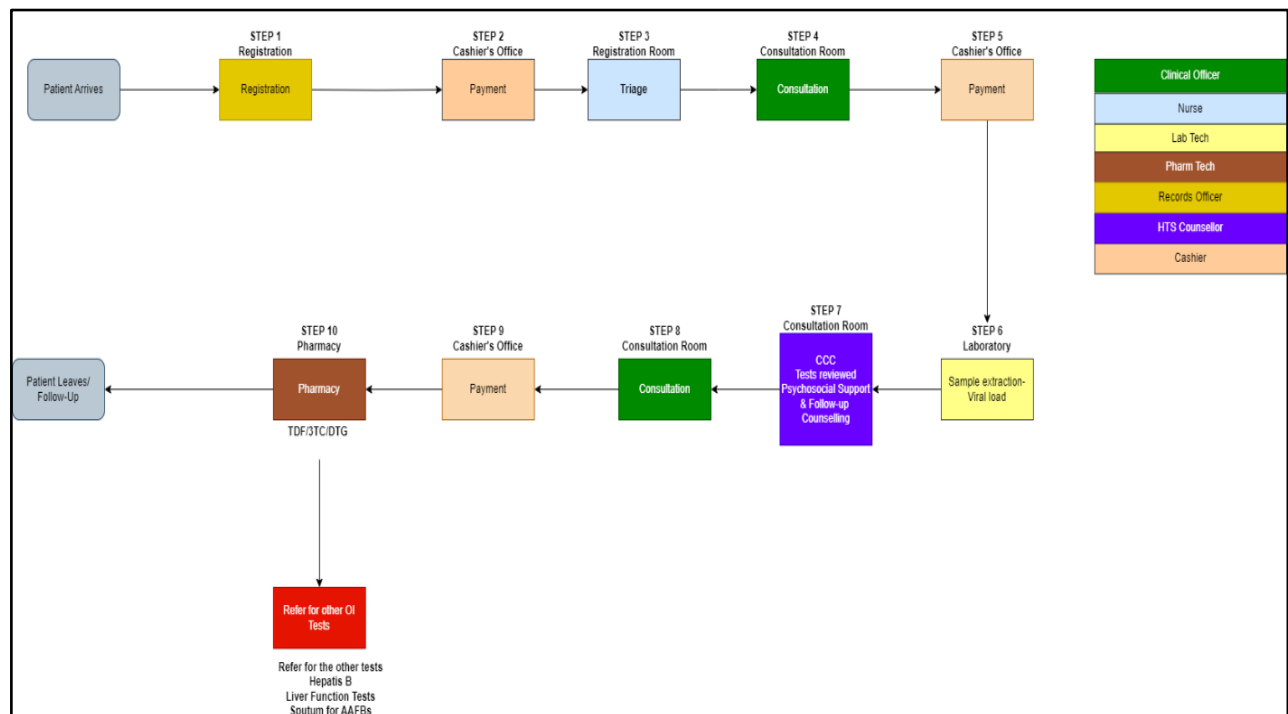


Figure 2. Process Map of HIV Treatment for Stable Adult ART Client (Source: Author, 2023)

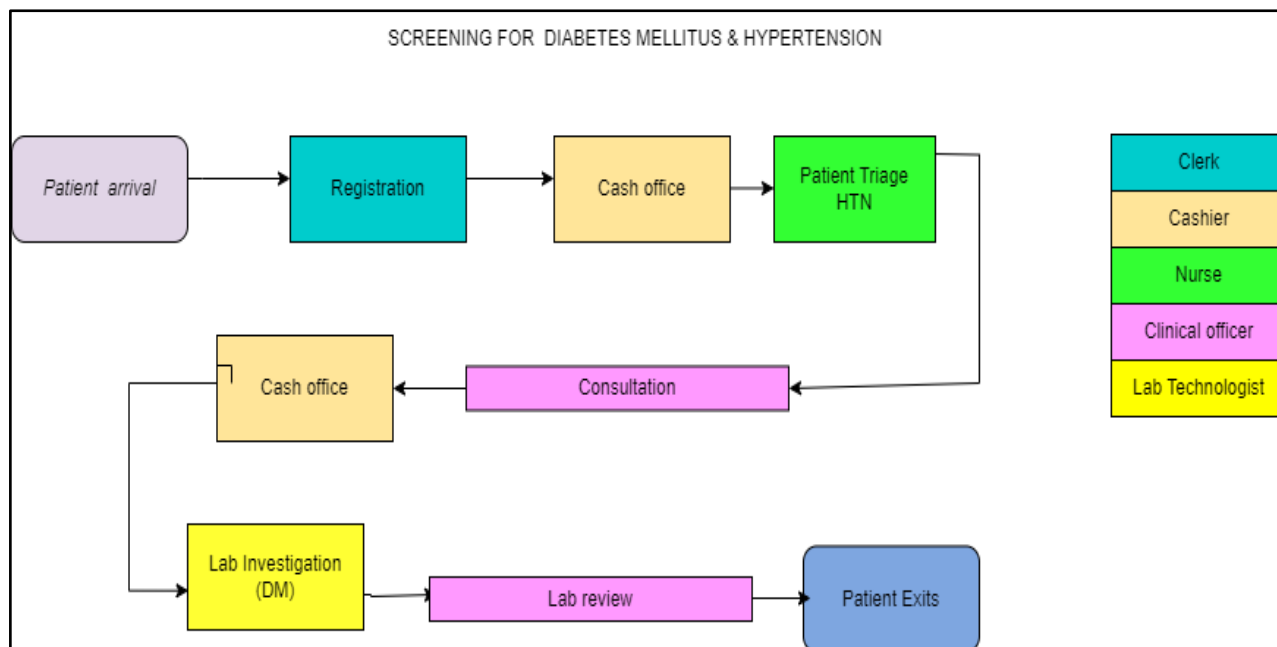


Figure 3. Process Map of Diabetes and Hypertension Screening (Source: Author, 2023)

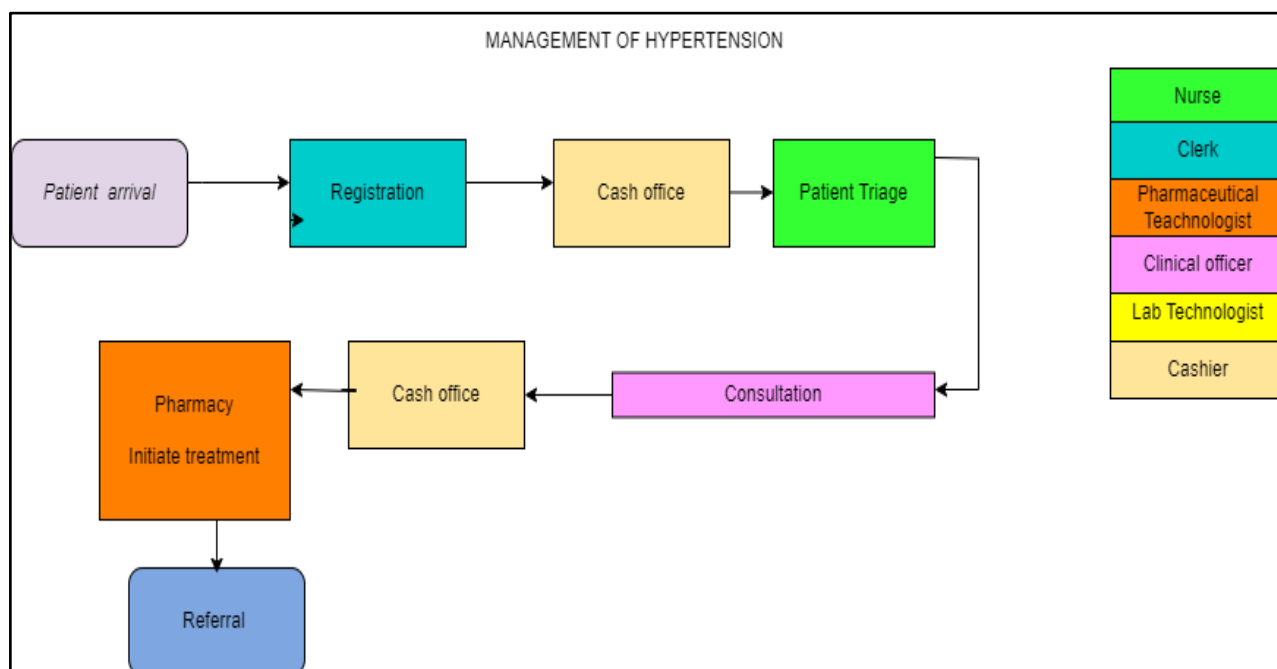


Figure 4. Process Map of Hypertension (HTN) Management (Source: Author, 2023)

Unit Costs of Patient Care Visit per HIV and NCD Intervention and Cost Drivers

The findings in Table 1 reveal the cost breakdown for providing HIV/AIDS services at different levels of care for unstable patients. The personnel costs range from 7,812.5 KES at Level 2 to 8,736.0 KES at Level 5. The drug costs remain consistent at 25,515.0 KES across all levels. Consumables costs range from 48.6 KES at Level 2 to 99.8 KES at Level 5. Overheads costs increase from 870.9 KES at Level 2 to 1,915.7 KES at Level 4. Capital costs range

from 77.2 KES at Level 2 to 97.2 KES at Level 5. The annualized costs increase from 34,324 KES at Level 2 to 36,239 KES at Level 5, equivalent to 245.2 USD to 258.8 USD.

Table 2 provides the cost breakdown for delivering NCD services at different levels of care for diabetes and hypertension. For diabetes, personnel costs range from 2,812.0 KES at Level 2 to 4,792.7 KES at Level 5, while drug costs remain consistent at 10,934.3 KES. Consumables costs range from 48.6 KES to 99.8 KES, and overheads

increase from 1,080.0 KES to 1,598.4 KES. Capital costs range from 30.0 KES to 88.0 KES. The annualized costs increase from 14,905 KES to 17,513 KES, equivalent to 106.5 USD to 125.1 USD. For hypertension, personnel costs range from 3,329.0 KES to 4,678.0 KES, while drug costs remain consistent at 9,385.7 KES. Consumables costs range from 48.6 KES to 84.0 KES, and overheads increase from

1,080.0 KES to 1,298.4 KES. Capital costs range from 30.0 KES to 88.0 KES. The annualized costs increase from 13,873 KES to 15,534 KES, equivalent to 99.1 USD to 111.0 USD. These findings highlight the costs associated with providing NCD services and can inform financial planning and resource allocation in delivering effective and sustainable care.

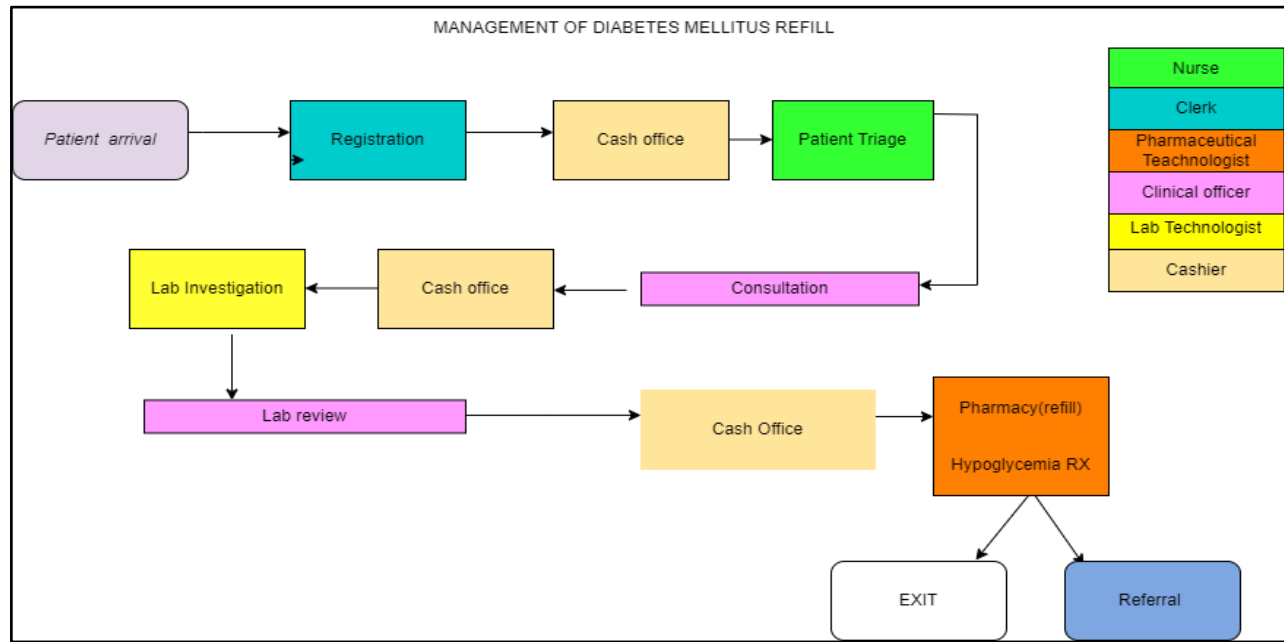


Figure 5. Process Map of Diabetes Mellitus (DM) Management (Source: Author, 2023)

Table 1. Average Unit Cost for HIV/AIDs per Facility Visit

HIV/AIDS		Level 2	Level 3	Level 4	Level 5
Unstable patients	Personnel (KES)	7,812.5	8,050.0	8,172.8	8,736.0
	Drugs (KES)	25,515.0	25,515.0	25,515.0	25,515.0
	Consumables (KES)	48.6	66.2	71.1	99.8
	Overheads (KES)	870.9	1,173.7	1,915.7	1,790.6
	Capital cost (KES)	77.2	79.8	89.9	97.2
	Annualized cost (KES)	34,324	34,885	35,765	36,239
New Treatment	Annualized cost (USD)	245.2	249.2	255.5	258.8
	Personnel (KES)	6,562.5	6,593.8	8,377.1	8,906.3
	Drugs (KES)	14,866.6	14,866.6	14,866.6	14,866.6
	Consumables (KES)	48.6	66.2	71.1	99.8
	Overheads (KES)	1,137.5	1,173.7	1,915.7	1,790.6
	Capital cost (KES)	77.2	79.8	89.9	105.8
Stable patients	Annualized cost (KES)	22,692	22,780	25,320	25,769
	Annualized cost (USD)	162.1	162.7	180.9	184.1
	Personnel (KES)	1,500.0	3,000.0	4,489.6	7,437.5
	Drugs (KES)	17,685.0	17,685.0	17,685.0	17,685.0
	Consumables (KES)	48.6	66.2	71.1	99.8
	Overheads (KES)	1,137.5	1,173.7	1,915.7	1,790.6
Stable patients	Capital cost (KES)	77.2	79.8	89.9	121.5
	Annualized cost (KES)	20,448	22,005	24,251	27,134
	Annualized cost (USD)	146.1	157.2	173.2	193.8

Source: Author calculations

Table 2. Average Unit Cost for Diabetes Mellitus and Hypertension per Facility Visit

NCDs		Level 2	Level 3	Level 4	Level 5
Diabetes	Personnel (KES)	2,812.0	3,125.0	4,353.1	4,792.7
	Drugs (KES)	10,934.3	10,934.3	10,934.3	10,934.3
	Consumables (KES)	48.6	66.2	62.3	99.8
	Overheads (KES)	1,080.0	1,173.7	1,470.0	1,598.4
	Capital cost (KES)	30.0	30.0	55.2	88.0
	Annualized cost (KES)	14,905	15,329	16,875	17,513
	Annualized cost (USD)	106.5	109.5	120.5	125.1
Hypertension	Personnel (KES)	3,329.0	3,624.0	4,281.3	4,678.0
	Drugs (KES)	9,385.7	9,385.7	9,385.7	9,385.7
	Consumables (KES)	48.6	66.2	62.3	84.0
	Overheads (KES)	1,080.0	1,173.7	1,470.0	1,298.4
	Capital cost (KES)	30.0	32.4	55.2	88.0
	Annualized cost (KES)	13,873	14,282	15,254	15,534
	Annualized cost (USD)	99.1	102.0	109.0	111.0

Source: Author calculations

Table 3. Average Unit Cost for HIV/AIDs, Diabetes Mellitus and Hypertension per Facility Visit with Integration Approach

INTEGRATION		Level 2	Level 3	Level 4	Level 5
HIV/Diabetes	Personnel (KES)	3,000.0	6,452.1	6,875.6	5,937.5
	Drugs (KES)	27,160.1	27,160.1	27,160.1	27,160.1
	Consumables (KES)	23.3	56.7	66.2	106.9
	Overheads (KES)	443.7	950.4	1,302.1	1,790.6
	Capital cost (KES)	47.4	72.5	80.8	88.0
	Annualized cost (KES)	30,675	34,692	35,485	35,083
	Annualized cost (USD)	219.1	247.8	253.5	250.6
HIV/HTN	Personnel (KES)	3,000.0	6,452.1	6,875.6	5,937.5
	Drugs (KES)	27,070.7	27,070.7	27,070.7	27,070.7
	Consumables (KES)	23.3	56.7	66.2	106.9
	Overheads (KES)	443.7	950.4	1,302.1	1,790.6
	Capital cost (KES)	47.4	75.2	80.8	88.0
	Annualized cost (KES)	30,585	34,605	35,395	34,994
	Annualized cost (USD)	218.5	247.2	252.8	250.0
HIV/DM/HTN	Personnel (KES)	3,000.0	6,452.1	6,875.6	5,937.5
	Drugs (KES)	36,545.9	36,545.9	36,545.9	36,545.9
	Consumables (KES)	23.3	56.7	66.2	106.9
	Overheads (KES)	443.7	950.4	1,302.1	1,790.6
	Capital cost (KES)	47.4	75.2	80.8	88.0
	Annualized cost (KES)	40,060	44,080	44,871	44,469
	Annualized cost (USD)	286.1	314.9	320.5	317.6

Source: Author, 2023 calculations

The integration of HIV/Diabetes and HIV/HTN services at different levels (Level 2, Level 3, Level 4, and Level 5) has various cost implications. In terms of personnel costs (in KES), the expenses range from 3,000.0 to 6,875.6 for HIV/Diabetes and HIV/HTN services. The costs for drugs (in KES) remain constant at 27,160.1 across all levels for both conditions. Consumables costs (in KES) increase slightly from 23.3 to 106.9 for HIV/Diabetes and HIV/HTN services. Overheads costs (in KES) also increase as the level

of integration progresses, ranging from 443.7 to 1,790.6. Capital costs (in KES) increase slightly from 47.4 to 88.0. The annualized cost (in KES) ranges from 30,675 to 35,485 for HIV/Diabetes and from 30,585 to 35,395 for HIV/HTN services. When converted to USD, the annualized cost (in USD) ranges from 218.5 to 253.5 for HIV/Diabetes and from 218.5 to 252.8 for HIV/HTN services.

On the other hand, the integration of HIV, diabetes (DM), and hypertension (HTN) services at different levels (Level 2,

Level 3, Level 4, and Level 5) has several advantages. In terms of personnel costs (in KES), the expenses range from 3,000.0 to 6,875.6. The costs for drugs (in KES) remain constant at 36,545.9. Consumables costs (in KES) increase slightly from 23.3 to 106.9, providing essential supplies for integrated services. Overheads costs (in KES) also increase as the level of integration progresses, ranging from 443.7 to 1,790.6, supporting the infrastructure and administrative needs. Capital costs (in KES) increase slightly from 47.4 to 88.0, allowing for necessary investments. The annualized cost (in KES) ranges from 40,060 to 44,871. When converted to USD, the annualized cost (in USD) ranges from 286.1 to 320.5, indicating a cost-effective approach to comprehensive healthcare delivery. See Table 3 above.

Cost Savings due to HIV/NCD Integration

The study estimated the costs per case that could be potentially saved by merging patient processes. This approach does not however suggest a change in treatment protocol and hence the cost of drugs has been excluded in the estimation of efficiency savings. The reason for combining NCD (Non-Communicable Disease) and HIV care is based on the economic argument of optimizing health services by taking advantage of economies of scale and scope. These efficiencies are assessed using the concept of "unit cost," which represents the total expenses incurred to produce a single unit of a product or service. Overall, integration of HIV and NCD service provision has demonstrated annual cost savings of KES 26706 (USD190.7), KES 27220

(USD194.4), and KES 48106 (USD343.6) per case if we integrate HIV/DM; or HIV/HTN; or HIV/DM/HTN respectively as shown in Table 4 below.

The integration of HIV and NCD service provision has proven to yield significant annual cost savings. Specifically, when we combine HIV and DM services, there is a cost reduction of 20 percent per case. Similarly, integrating HIV and Hypertension (HTN) services leads to a cost savings of 21 percent per case. Furthermore, when we integrate HIV, Diabetes, and Hypertension (DM/HTN) services together, the cost savings increase to an impressive 31 percent per case.

The integration of HIV and NCD services at different levels has resulted in significant cost savings. When HIV and Diabetes services are combined (Level 2), annualized savings of 6,922 KES (49.4 USD) per case were achieved. At Level 3, integrating HIV and Hypertension (HTN) services yielded annualized savings of 7,439 KES (53.1 USD) per case. The most comprehensive integration, combining HIV, Diabetes, and Hypertension (DM/HTN) services at Level 4 and Level 5, resulted in even greater savings. At Level 4, the annualized savings were 11,410 KES (81.5 USD) per case, while at Level 5, the savings amounted to 15,163 KES (108.3 USD) per case. These savings encompass personnel costs, consumables, overheads, and capital costs, and demonstrate the financial benefits of integrating HIV and NCD services in healthcare settings. Table 5 shows the detailed savings that could accrue by integrating HIV and NCD service provision by input and level of care.

Table 4. Summary Annual Average Saving per Unit Cost with Integration Approach

	Level 2	Level 3	Level 4	Level 5	Overall
HIV/DM	KES 6,922 (USD49.4)	KES 4,064 (USD29)	KES 6,706 (USD47.9)	KES 9,014 (USD64.4)	KES 26,706 (USD190.7)
HIV/HTN	KES 7,439 (USD53.1)	KES 4,563 (USD32.6)	KES 6,634 (USD47.4)	KES 8,584 (USD61.3)	KES 27,220 (USD194.4)
HIV/DM/HTN	KES 11,410 (USD81.5)	KES 8,958 (USD64)	KES 12,575 (USD89.8)	KES 1,5163 (USD108.3)	KES 48,106 (USD343.6)

Source: Author, 2023 calculations

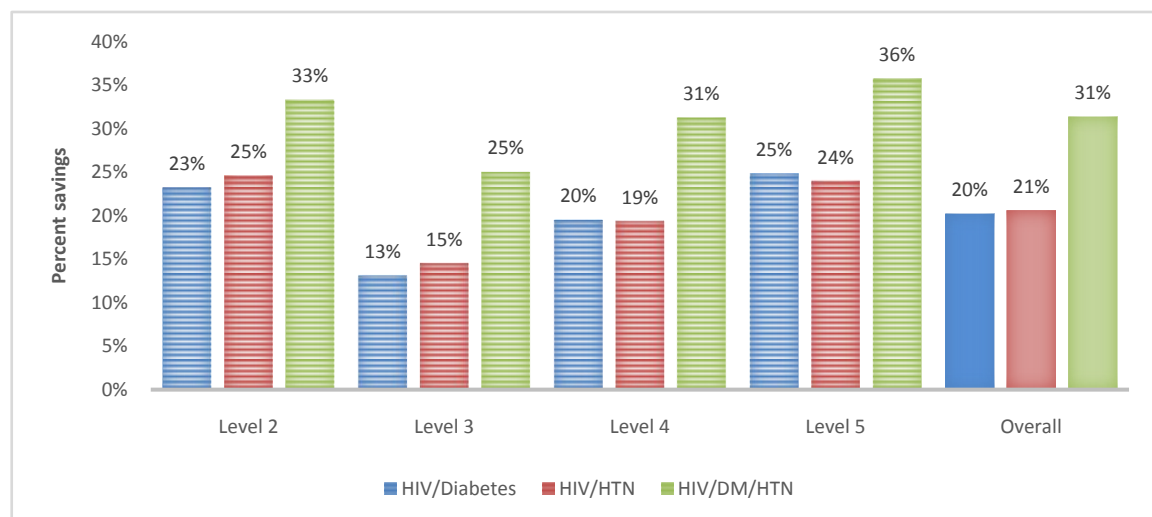


Figure 6. Summary Annual Average Saving per Unit Cost with Integration Approach (Source: Author calculations)

Table 5. Average Annual Saving per Unit Cost for HIV/AIDs, Diabetes Mellitus and Hypertension per Facility Visit with Integration Approach

Savings		Level 2	Level 3	Level 4	Level 5
HIV/Diabetes	Personnel (KES)	5,103.7	2,554.1	4,490.7	7,215.1
	Consumables (KES)	73.8	75.7	67.2	92.7
	Overheads (KES)	1,684.9	1,396.9	2,083.6	1,598.4
	Capital cost (KES)	59.8	37.3	64.3	108.2
	Annualized Saving (KES)	6,922	4,064	6,706	9,014
	Annualized Saving (USD)	49.4	29.0	47.9	64.4
HIV/HTN	Personnel (KES)	5,620.7	3,053.1	4,418.8	7,100.4
	Consumables (KES)	73.8	75.7	67.2	76.9
	Overheads (KES)	1,684.9	1,396.9	2,083.6	1,298.4
	Capital cost (KES)	59.8	37.0	64.3	108.2
	Annualized Saving (KES)	7,439	4,563	6,634	8,584
	Annualized Saving (USD)	53.1	32.6	47.4	61.3
HIV/DM/HTN	Personnel (KES)	8,432.7	6,178.1	8,771.9	11,893.1
	Consumables (KES)	122.4	142.0	129.6	176.7
	Overheads (KES)	2,764.9	2,570.6	3,553.6	2,896.8
	Capital cost (KES)	89.8	67.0	119.5	196.2
	Annualized Saving (KES)	11,410	8,958	12,575	15,163
	Annualized Saving (USD)	81.5	64.0	89.8	108.3

Source: Author, 2023 calculations

4. Discussion

The study yields unique insights into HIV/NCD integration. The study findings presented highlight the significant cost savings achieved through the integration of HIV and non-communicable disease (NCD) services at different levels of care. The integration of HIV and NCD services has been demonstrated to generate cost savings across multiple levels of care. The cost savings per case, as shown in the findings, indicate that integrating these services can lead to efficient resource utilization and reduced healthcare expenditures. These finding aligns with that of Golovaty, Ilya, et al. who reported that HIV-NCD integration for the health system and patients increase efficiency of resource use and help patients remain in care by reducing costs and inconvenience for patients with multiple morbidities [15]. This cost-saving is crucial for healthcare systems aiming to provide high-quality care while managing limited resources and sustain services.

Additionally, the cost savings are amplified with higher levels of integration. As the level of integration increases, the savings per case also increase. This can be attributed to the fact that higher-level facilities tend to have larger patient volumes and a broader catchment area [16]. This high patient flow allows them to benefit from economies of scale. They can negotiate better prices for medical supplies, drugs, and equipment due to increased purchasing power. This finding is consistent with that of Shiri, Tinevimbo, et al. who reported that HIV/NCD integration promote compliances, and may lead to increased economies-of-scale [17].

Additionally, a higher patient load enables efficient utilization of resources, such as expensive medical equipment or specialized staff, resulting in reduced per-patient costs. While level five facilities may generate more cost savings, it is important to note that the healthcare system requires a well-functioning network of different levels of care, including primary and secondary facilities. Each level plays a crucial role in delivering appropriate and cost-effective care based on the complexity and severity of patients' conditions. Effective referral systems and coordination among different levels of care are essential to ensure optimal healthcare outcomes and cost efficiency across the entire healthcare system.

The integration of HIV and NCD services can promote a comprehensive and patient-centered approach to healthcare. An organization that embraces a team oriented organization culture have a higher likelihood of having a sustainable health services, enhancing continuous care even after the donors fully pull out.. This finding is consistent with that of Singh, Sabine, et al. who reported that Integrated services can save resources and allow for a more personalized approach to healthcare [18]. By addressing multiple conditions within a single service delivery model, patients receive more holistic care that considers their overall health. This integrated approach can lead to improved patient outcomes, better disease management, and reduced healthcare costs associated with treating complications arising from uncontrolled HIV or NCDs.

Integrating HIV and NCD services streamlines healthcare delivery and optimizes resource allocation. The cost savings

identified in the findings encompass various components such as personnel costs, consumables, overheads, and capital costs. Achwoka, Dunstan, et al. indicated that from the supply side, integration can reduce redundancies in resource limited settings. For example, leveraging existing infrastructure such as buildings, laboratory and supply chains can generate economic savings while joint supervision, training and mentorship has been shown to reduce demand on health workers' time [19]. By eliminating redundancies and maximizing the use of available resources, healthcare systems can allocate saved resources to other areas of need, such as expanding access to care, investing in preventive measures, or enhancing healthcare infrastructure.

The study was subject to one limitation, the assessment of the societal perspective was not included in this study, despite the potential savings that could be associated with patient transportation and patients' time.

In conclusion, findings provide evidence to support the development and implementation of policies and programs that promote the integration of HIV and NCD services. Governments, healthcare organizations, and policymakers can use this information to advocate for integrated care models, incorporating them into national healthcare plans and guidelines. These policies can guide the allocation of resources and promote the sustainability of integrated services. Moreover, the integration of HIV and NCD services contributes to the overall strengthening of healthcare systems. Integrated care models require collaboration among different healthcare providers, disciplines, and sectors. This collaboration fosters a more coordinated and efficient healthcare system, ultimately benefiting the entire population, not just individuals living with HIV or NCDs. However, the successful implementation of integrated care will necessitate mobilization of additional funds to expand HIV treatment programs to include intensified screening and management of NCDs. Despite the growing prevalence of NCDs, the current funding allocated to NCD interventions are insufficient. It is also essential to consider the context in which these findings were obtained and adapt them accordingly to specific healthcare settings and populations. Additionally, ongoing monitoring and evaluation of integrated services are crucial to assess their long-term impact on patient outcomes, healthcare costs, and health system performance.

Declarations

Ethical approval and consent to participate.

Not applicable.

Conflict of Interest

The authors declare no conflict of interest.

REFERENCES

- [1] Kemp CG, Weiner BJ, Sherr KH, Kupfer LE, Cherutich PK, Wilson D, et al. Implementation science for integration of HIV and non-communicable disease services in sub-Saharan Africa: A systematic review. *AIDS*. 2018 Jul 1; 32: S93–105.
- [2] UNAIDS. Responding to the Challenge of Non-communicable Diseases. 2016 [cited 2021 Apr 27]; Available from: <https://doi.org/10.1136/bmj.d5506>.
- [3] Negin J, Mills EJ, Bärnighausen T. Aging with HIV in Africa: the challenges of living longer. *AIDS (London, England)*. 2012; 26(0 1): S1.
- [4] Marcus JL, Leyden WA, Alexeeff SE, Anderson AN, Hechter RC, Hu H, et al. Comparison of overall and comorbidity-free life expectancy between insured adults with and without HIV infection, 2000-2016. *JAMA network open*. 2020; 3(6): e207954–e207954.
- [5] Gui LIU, SHARMA M, Nicholas TAN, BARNABAS R. HIV-positive women have higher risk of HPV infection, precancerous lesions, and cervical cancer: A systematic review and meta-analysis. *AIDS (London, England)*. 2018; 32(6): 795.
- [6] Masupe T, Mashalla Y, Seloilwe E, Jibril H, Medhin H. Integrated management of HIV/NCDS: Knowledge, attitudes, and practices of health care workers in Gaborone, Botswana. *African Health Sciences*. 2019 Sep 1; 19(3): 2312–23.
- [7] Armstrong EP, Charland SL. Burden of illness of hepatitis C from a managed care organization perspective. *Current medical research and opinion*. 2004; 20(5): 671–9.
- [8] Adeyemi O, Lyons M, Njim T, Okebe J, Birungi J, Nana K, et al. Integration of non-communicable disease and HIV/AIDS management: a review of healthcare policies and plans in East Africa. *BMJ global health*. 2021; 6(5): e004669.
- [9] Michel J, Tediosi F, Egger M, Barnighausen T, McIntyre D, Tanner M, et al. Universal health coverage financing in South Africa: wishes vs reality. *Journal of Global Health Reports*. 2020; 4: e2020061.
- [10] Nugent R, Barnabas RV, Golovaty I, Osetinsky B, Roberts DA, Bisson C, et al. Costs and cost-effectiveness of HIV/NCD integration in Africa: From theory to practice. *AIDS (London, England)*. 2018; 32(Suppl 1): S83.
- [11] McBain RK, Jerome G, Warsh J, Browning M, Mistry B, Faure PAI, et al. Rethinking the cost of healthcare in low-resource settings: the value of time-driven activity-based costing. *BMJ Global Health [Internet]*. 2016 Nov 1; 1(3). Available from: <http://gh.bmj.com/content/1/3/e000134.abstract>.
- [12] Kaplan RS, Anderson SR. Time-driven activity-based costing: a simpler and more powerful path to higher profits. Harvard business press; 2007.
- [13] Quantification Report for HIV commodities For the Years 2019/20 to 2021/2022. Available from: <https://www.nascop.or.ke/commodities-and-logistics-downloads/>.
- [14] Kenya Medical Supplies Authority price list. Available from: <https://www.kemsa.co.ke/salespricelist/>.
- [15] Golovaty I, Sharma M, Van Heerden A, van Rooyen H,

- Baeten JM, Celum C, et al. Cost of integrating non-communicable disease screening into home-based HIV testing and counseling in South Africa. *Journal of acquired immune deficiency syndromes* (1999). 2018; 78(5): 522.
- [16] Kintu A, Sando D, Okello S, Mutungi G, Guwatudde D, Menzies NA, et al. Integrating care for non-communicable diseases into routine HIV services: key considerations for policy design in sub-Saharan Africa. *Journal of the International AIDS Society*. 2020; 23: e25508.
- [17] Shiri T, Birungi J, Garrib AV, Kivuyo SL, Namakoola I, Mghamba J, et al. Patient and health provider costs of integrated HIV, diabetes and hypertension ambulatory health services in low-income settings—an empirical socio-economic cohort study in Tanzania and Uganda. *BMC medicine*. 2021; 19(1): 1–15.
- [18] Singh S, Kirk O, Jaffar S, Karakezi C, Ramaiya K, Kallestrup P, et al. Patient perspectives on integrated healthcare for HIV, hypertension and type 2 diabetes: a scoping review. *BMJ open*. 2021; 11(11): e054629.
- [19] Achwoka D, Waruru A, Chen TH, Masamaro K, Ngugi E, Kimani M, et al. Noncommunicable disease burden among HIV patients in care: a national retrospective longitudinal analysis of HIV-treatment outcomes in Kenya, 2003-2013. *BMC public health*. 2019; 19(1): 1–10.