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Ministry of Health

Documentation of the Magnitude of Advanced HIV Diseases and Non-Communicable Diseases Among People living with HIV in Cambodia

March 2025

National Center for HIV/AIDS, Dermatology and STD

Acknowledgments

We express our profound gratitude to the US-CDC Cambodia for all their invaluable financial and technical support to finalize the documentation of "The Magnitude of Advanced HIV Diseases and Non-communicable diseases Among People living with HIV (PLHIV) in Cambodia". This documentation significantly deepened our understanding of **Advanced HIV disease** and **non-communicable diseases** among PLHIV currently on ART. This understanding is crucial for effective public health planning focused on the prevention and treatment of both AHD and NCDs. Furthermore, the insights gained into the burden of AHD and NCDs among PLHIV will serve as a guide for strengthening Cambodia's health systems and integrating service delivery to improve the quality of life among PLHIV.

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Phnom Penh, 31 / March 2025

Director of National Center for HIV/AIDS, Dermatology and STD

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List of Abbreviations and Acronyms

Abbreviation	Definition
3TC	Lamivudine
ABC	Abacavir
AIDS	Acquired Immunodeficiency Syndrome
AHD	Advanced HIV Disease
AOR	Adjusted Odds Ratio
ART	Antiretroviral Therapy
ARV	Antiretroviral (Drug)
ATV/r	Atazanavir/Ritonavir
BP	Blood Pressure
CD4	T-CD4+ Lymphocyte
CI	Confidence Interval
CrAg	Cryptococcus Antigen
CSF	Cerebrospinal Fluid
DTG	Dolutegravir
HbA1c	Hemoglobin A1C
HICs	High-Income Countries
HTN	Hypertension
INSTI	Integrase Strand Transfer Inhibitors
LAM-TB Ag	Lipoarabinomannan for TB Screening
LF-LAM	Lateral Flow Urine Lipoarabinomannan Assay
LMICs	Low- and Middle-Income Countries
MOH	Ministry of Health
MTB/RIF	Mycobacterium Tuberculosis and Resistance to Rifampicin
NCDs	Non-Communicable Diseases
NCHADS	National Center for HIV/AIDS, Dermatology, and STD
OGTT	Oral Glucose Tolerance Test
OI	Opportunistic Infection
PAC	Pediatric AIDS Care
PASP	Provincial AIDS and STD Program
PCP	Pneumocystis Pneumonia
PI	Protease Inhibitor
PLHIV	People living with HIV
RH	Referral Hospital
SD	Standard Deviation
SOP	Standard Operating Procedure
T2D/T2DM	Type 2 Diabetes Mellitus
TDF	Tenofovir Disoproxil Fumarate
TB	Tuberculosis
US-CDC	United States Centers for Disease Control and Prevention
VL	Viral Load
WHO	World Health Organization
WOPS	Well-Being of Older People Study
YLWH	Years Living with HIV

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Documentation of the Magnitude of Advanced HIV Diseases and Non-Communicable Diseases Among PLHIV in Cambodia

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Research Abstract

Background: Advanced HIV diseases (AHD) and the increasing burden of non-communicable diseases (NCDs), particularly hypertension and Type 2 Diabetes Mellitus(T2DM), present growing challenges for People living with HIV (PLHIV) globally. Although expanded antiretroviral therapy coverage has improved survival for PLHIV, AHD remains a major contributor to AIDS-related mortality, often linked to late diagnosis, and lack of treatment. At the same time, NCDs also increasingly complicate long-term HIV care. In Cambodia, evidence on the burden of AHD and NCDs among PLHIV is limited. This study assessed the prevalence of AHD and NCD comorbidities, and the accessibility of screening and treatment services, to inform integrated and effective healthcare strategies for PLHIV in Cambodia.

Methods: A cross-sectional desk review of national medical records was conducted across nine purposively selected ART clinics in Cambodia. From September to December 2024, 297 records (33 per clinic) were random selected from PLHIV aged ≥15 years. Data collected included ART history, AHD status (defined by CD4 count or clinical stage), and screening/treatment uptake for AHD, hypertension, and T2DM.

Results: Among 297 participants (55.3% were male, the mean age of 43 ± 12.5 years), and 60.6% had been on ART for over ten years, and 93.3% were on dolutegravir-based regimen. Despite long-term treatment, 38.0% (n=113) presenting with AHD. Prophylactic coverage for AHD was suboptimal: 56.6% received cotrimoxazole, 50.0% fluconazole, and 89.4% tuberculosis preventive treatment. Regarding NCDs, hypertension screening coverage was high (95.6%), with 7.4% of the total cohort receiving antihypertensive treatment. Conversely, T2DM screening was low (12.5%); however, of those screened, 27.0% met diagnostic criteria. Only 4.1% of the total cohort were on T2DM treatment. Access to NCDs treatment was fragmented, occurring through ART clinics, internal referrals, or private providers, with follow-up frequently undocumented.

Conclusion: A substantial burden of AHD and NCD comorbidities persists among PLHIV in Cambodia despite long-term ART use. Gaps in AHD prophylaxis and the low T2DM screening rate highlight a critical need to integrate routine NCD diagnostics and AHD management into HIV care. Strengthening referral mechanisms and documentation is essential to reduce both AIDS-related and NCD-related mortality.

I. Introduction

Advanced HIV disease defined by the World Health Organization as occurring in People living with HIV who have a CD4 cell count below 200 cells/mm³, those presenting with WHO Stage 3 or 4 conditions, or all children under five years of age living with HIV. Individuals with AHD face a significantly higher risk of AIDS-related complications, including tuberculosis, cryptococcal meningitis, histoplasmosis, and severe bacterial infections. To address these risks, WHO recommends a comprehensive care package for AHD, which includes screening, diagnosis, prophylaxis, and enhanced adherence counselling for affected individuals [1].

Despite substantial progress in expanding access to HIV testing and treatment, AHD remains a major challenge globally. It continues to contribute significantly to AIDS-related mortality. In 2021 alone, 650,000 people died from AIDS-related causes—most of whom had advanced HIV. Alarmingly, these death rates have shown little decline in recent years, indicating that current strategies are insufficient to achieve global targets for ending AIDS by 2030 [2].

A large proportion of individuals presenting with AHD in hospitals are already aware of their HIV-positive status. In low HIV-burden settings, provider-initiated testing and counselling should be offered to individuals presenting with conditions suggestive of HIV. In high HIV-burden settings, WHO recommends routine HIV testing for all individuals seeking care at health facilities, to enable earlier diagnosis and timely linkage to treatment [3].

PLHIV who are hospitalized or present with severe illness should undergo CD4 cell count testing, as it is essential for assessing the risk of opportunistic infections and performing clinical management. Additionally, all children under the age of five living with HIV are classified as having AHD due to their heightened vulnerability to disease progression and mortality [4].

II. Rationale

Individuals with advanced HIV disease face a significantly increased risk of mortality as CD4 cell counts decline, even after initiating antiretroviral therapy (ART). The leading causes of severe illness and death in this population include tuberculosis, severe bacterial infections, and cryptococcal meningitis.

Chronic noncommunicable diseases remain the leading cause of death and disability worldwide, often resulting in long-term health complications that require ongoing treatment and care. Cervical cancer, though largely preventable, is the fourth most common cancer and a major cause of cancer-related deaths among women globally. Women living with HIV are at particularly high risk due to their weakened immune response to human papillomavirus (HPV), the primary cause of nearly all cervical cancers. Globally, around 1 in 20 cervical cancer cases is attributable to HIV, rising to 1 in 5 in sub-Saharan Africa [5].

In lower-middle-income countries (LMICs), both HIV and NCDs represent pressing public health challenges. The convergence of the HIV epidemic with the growing prevalence of NCDs has created a complex and increasing burden on health systems [6]. Conditions such as hypertension, diabetes mellitus, and cancer are both directly and indirectly associated with HIV and ART. The increasing prevalence of NCDs in developing countries is largely driven by changing lifestyles, dietary habits, and increased life expectancy [6]. This dual burden underscores the urgent need for integrated healthcare approaches to manage these interconnected health challenges effectively.

Emerging research has shed light on how HIV increases the risk of several NCDs. Chronic HIV-related inflammation can damage blood vessels, contributing to atherosclerosis and the development of high-risk plaques, thereby raising the risk of cardiovascular diseases (CVDs) [7]. Moreover, certain ART regimens have been linked to metabolic side effects such as elevated cholesterol, abdominal fat accumulation, and high blood pressure [8]. ART has also been associated with insulin resistance and metabolic syndrome, further elevating the risk of NCDs among PLHIV [8, 9].

Understanding the extent and nature of NCDs among PLHIV is essential for effective public health planning and the development of strategies to prevent and manage this dual epidemic. Identifying optimal clinical interventions and policy responses is critical to addressing the combined burden of HIV and NCDs.

Comprehensive data on the prevalence and burden of NCDs among PLHIV can guide policymakers in strengthening health systems and promoting integrated service delivery. These insights are especially important for Cambodia, where integrating NCDs and HIV services at the primary care level can significantly improve the quality and continuity of care.
Premature deaths from hypertension, type 2 diabetes mellitus, and cervical cancer are largely preventable. Strengthening the integration of HIV care with NCDs services—particularly in cervical cancer prevention and control—can support Cambodia's efforts to eliminate cervical cancer as a public health concern.

Although various initiatives have been implemented in LMICs to address the burden of T2DM, hypertension, cancer, and other NCDs, there is limited evidence of their effectiveness, particularly among PLHIV in Cambodia. Despite the evident need, several systemic challenges—such as limited funding, shortages of healthcare workers and essential medicines, weaker health information systems, service delivery, and governance issues—may hinder progress. However, the specific gaps in the management of T2DM, hypertension, and cancer among PLHIV in Cambodia remain poorly documented.
The prevention, detection, and management of NCDs among PLHIV are complex and require coordinated efforts among multiple stakeholders—including policymakers, healthcare providers, patients, funders, and educators—each with distinct roles and responsibilities.

To date, no data on the prevalence of NCDs and advanced HIV disease among PLHIV in Cambodia. This study was conducted to assess the prevalence of common NCDs, estimate the burden of both NCDs and AHD, and evaluate access to diagnosis and treatment among adult males and females living with HIV. The

findings will provide essential insights to inform prevention, control, and management strategies for NCDs within this population.

III. Literature review

A retrospective analysis of program data from 2003 to 2013, including 5,642 HIV-infected individuals enrolled in care, found that the median CD4 cell count increased from 32 cells/μL in 2003 to 239 cells/μL in 2013 at the time of diagnosis. Despite this increase, a high prevalence of Advanced HIV Disease remains a global issue [6]. Unexpected to identify advanced HIV disease at the time of diagnosis or re-engagement in HIV care, and AHD significantly increases the risk of death from opportunistic infections (OIs). The World Health Organization (WHO) provides evidence-based guidelines for a comprehensive package of interventions to prevent, diagnose, and treat common OIs, including tuberculosis (TB), cryptococcal meningitis, and severe bacterial infections. To mitigate AHD-related mortality, PEPFAR supports the rapid initiation of antiretroviral therapy (ART) with integrase inhibitor-based regimens and the implementation and documentation of tuberculosis preventive treatment (TPT) [7].

Exploration of the unmet need for palliative care in advanced HIV disease concluded that three non-parallel workstreams should be linked and integrated: the further scale-up of ART through outpatient programs, the greater implementation of the WHO-recommended advanced HIV disease care package, and the development of a comprehensive palliative care model for people living with HIV (PLHIV) to bridge the service gap between outpatient and inpatient care [8].

Opportunistic infections (OIs) have defined CD4 thresholds: Pneumocystis pneumonia is linked to a CD4 count <200 cells/mm³, and toxoplasmosis and cryptococcal infections are associated with counts <100 cells/mm³. Despite successes in improving HIV care and promoting earlier detection, a notable proportion of people living with HIV (PLHIV) continue to present with advanced disease. This is evidenced by the fact that in 2015, more than 20% of newly diagnosed individuals in the United States had a CD4 count of less than 200 cells/mm³ [9].

In an analysis among 482 people living with HIV (PLHIV) in Paraguay who had a CD4+ T-cell test, 79% had a CD4 count <200 cells/mm³. Of those with low CD4 counts, 38% had an opportunistic infection. The antigen test positivity rates were 16% for TB-LAM, 9% for Histoplasma antigen (HisAg), and 11% for cryptococcal antigen (CrAg). Among the 34 patients receiving cerebrospinal fluid (CSF) CrAg tests, 21 (62%) were positive, confirming cryptococcal meningitis [10].

An observational cohort evaluation of 537 HIV-positive patients screened for AHD found that 150 (27.9%) were found to have AHD, 109 of these patients were subsequently enrolled to study 6-month outcomes following rapid ART initiation. The mean participant age was 38 years (56.9% men). Key baseline findings at the initial clinic visit included 7.3% already on treatment, 33% with presumptive TB, and 12.8% (5/39)

positivity for CrAg among those screened. Ultimately, 77 (70.6%) of the 109 enrolled patients-initiated ART immediately, while 32 delayed initiations (median delay: 14 days) [11].

A retrospective analysis was conducted using routine program data from 2016 to 2019 in Kenya. It was found that 34% of 19,427 HIV-positive clients presented with advanced disease (CD4 count <200 cells/mm³ or a WHO Stage III/IV). Further analysis of a subset of 1,845 high-risk individuals revealed that 79% were at WHO Stage III/IV at enrolment. Major presenting co-morbidities at ART initiation included tuberculosis (13%), chronic diarrhoea (10%), and pneumocystis pneumonia (5%) [12].

Hypertension

The prevalence rates of NCDs and related risk factors among PLHIV in Cambodia were examined, revealing that the prevalence of hypertension was 15.1%. No statistically significant differences were found in the prevalence of hypertension and diabetes mellitus between men and women [13]. Although antiretroviral medications have significantly reduced mortality rates. Nevertheless, the incidence of cardiovascular disease-related mortality has notably increased among PLHIV [14, 15]. Hypertension, a well-established risk factor for cardiovascular disease and mortality [16-18], remains a significant clinical concern in this population. The prevalence of hypertension among PLHIV has surged, largely due to increased life expectancy resulting from expanded access to antiretroviral medications [19, 20]. Furthermore, ccertain HIV-related health factors have also been linked to hypertension in this population. Some studies suggest that the use of specific antiretroviral medications, particularly those in the protease inhibitors (PIs) and integrase strand transfer inhibitors (INSTIs) classes, may contribute to the incidence of metabolic syndrome and weight gain, thereby increasing the risk of hypertension [21-24].

Data collected from 1996 to 2014, analysed across 49 studies and 63,554 participants in a systematic review and meta-analysis, established the estimated prevalence of hypertension in the overall sample as 25.2% (95% CI: 21.2%, 29.6%). Notably, prevalence was higher among ART-experienced individuals (34.7%, 95% CI: 27.4%, 42.8%) compared to ART-naïve participants (12.7%, 95% CI: 7.4%, 20.8%) [25].

Research among 242 PLHIV on ART at Tosamaganga District Hospital, Tanzania, established a hypertension prevalence of 26%. A critical finding was that 77% of the 62 hypertensive subjects were either unaware of their diagnosis or not receiving appropriate treatment. The study also used multivariate analysis to identify older age, higher BMI, and lower baseline T-CD4 count as predictors of hypertension in this specific cohort [26]. A cross-sectional study of 9,839 PLHIV aged 20 years and above, who received care between 2016 and 2019 at one of the three Central Africa International Epidemiology Databases to Evaluate AIDS (IeDEA) sites in Cameroon, found that 66.2% of participants were women and 25.0% had prevalent hypertension (age-standardized prevalence 23.9%, 95% CI: 22.2-25.6%). Among those with hypertension, only 28 (1.1%) were on blood pressure (BP) lowering treatment, and 6 of these (21.4%) achieved target BP levels. The median age (47.4 vs. 40.5 years), self-reported duration of HIV infection (5.1 vs. 2.8 years),

duration of ART exposure (4.7 vs. 2.3 years), and CD4 count (408 vs. 359 cells/mm3) were higher in hypertensive individuals compared to non-hypertensive (all p <.001) [27].

In 2021, a cross-sectional study investigated hypertension prevalence among People living with HIV (PLHIV) aged ≥18 years in Zambia, utilizing data extracted from the national Electronic Health Records (EHR), which covers approximately 90% of all treated PLHIV. The analysis included 750,098 PLHIV with ≥2 clinical visits during the year. Of these, 101,363 (13.5%) had ≥2 recorded blood pressure readings. The study determined that the prevalence of hypertension was 14.7% (95% CI: 14.5–14.9) among those measured. Critically, only 8.9% of PLHIV diagnosed with hypertension had anti-hypertensive medication recorded in their HER [28]. And a cross-sectional study conducted at a Nigerian hospital found the prevalence of hypertension among PLHIV to be 24.9%. The study identified significant predictors of hypertension, including age (OR = 1.112, CI = 1.074 - 1.151, p < 0.001), higher BMI (OR = 1.087, CI = 1.024 - 1.154, p = 0.004), and longer duration on ART (OR = 1.169, CI = 1.090 - 1.254, p < 0.001). A significant clinical gap was noted, as only 24.4% of participants with hypertension had controlled blood pressure [29].

Analysis of cross-sectional data from the WHO SAGE WOPS (2011–2013), involving 514 older PLHIV. The study found that the prevalence of hypertension among PLHIV was 50.1%. The risk of hypertension increased with age. Compared to PLHIV aged 50-59, those aged 60-69 years [OR = 2.2; CI = 1.30, 3.84], 70-79 years [OR = 2.8; CI = 1.37, 5.82], and 80+ years [OR = 4.9; CI = 1.68, 14.05] had a higher risk of hypertension. Additionally, females were more likely [OR = 5.5; CI = 2.67, 11.12] than males to have hypertension [30].

T2DM: Type 2 Diabetes Mellitus

Data from a systematic review on diabetes and prediabetes in African adults living with HIV (analysing up to 86,412 participants) indicated that the overall prevalence of diabetes was 5.1% (95% CI: 4.3–5.9) and prediabetes was 15.1% (95% CI: 9.7–21.5). The review observed that self-reported diabetes prevalence (3.5%) significantly underestimated the true burden compared to rates calculated by combining self-reports with biochemical assessments (6.2% to 7.2%) [31].

An analysed baseline diabetes-relevant data from 1,947 adult participants in the CICADA study in Mwanza, Tanzania, which included 655 HIV-uninfected individuals, 956 HIV-infected ART-naïve individuals, and 336 HIV-infected individuals on ART. WHO guidelines for hemoglobin A1c (HbA1c) and the oral glucose tolerance test (OGTT) defined diabetes and prediabetes. The results showed that the mean age of participants was 41 (SD 12) years, with 59% being women. The prevalence of diabetes was 13% by HbA1c and 6% by OGTT, with partial overlap among participants identified by both tests. Compared to HIV-uninfected individuals, HIV-infected ART-naïve participants had increased relative risks of diabetes (HbA1c: RRR = 1.95, 95% CI 1.25-3.03; OGTT: RRR = 1.90, 95% CI 0.96-3.73) and prediabetes (HbA1c:

RRR = 2.89, 95% CI 1.93-4.34; OGTT: RRR = 1.61, 95% CI 1.22-2.13). HIV-infected participants on ART showed an increased risk of prediabetes (RRR 1.80, 95% CI 1.09, 2.94) by HbA1c, but not diabetes. A CD4 count < 200 cells/μl at recruitment increased the risk of diabetes, while physical activity decreased the risk of diabetes according to both HbA1c [32].

A cross-sectional study of 989 PLHIV in Texas, using data from the 2015–2017 Texas and Houston Medical Monitoring Project, examined the prevalence of T2DM. T2DM was identified based on formal medical chart diagnosis, insulin/oral hypoglycaemic prescriptions, or fasting blood glucose ≥126 mg/dL. T2DM-adjusted prevalence ratios and 95% confidence intervals (CIs) were estimated using multiple logistic regression. The study population was predominantly male (72%), ≥40 years old (68%), with 31% classified as overweight and 28% as obese. Approximately 62% of participants were virally suppressed. The overall prevalence of T2DM was 15%, with variations by age, body mass index (BMI), education, and health insurance ($p < 0.05$ for all). Compared to PLHIV ≥60 years, individuals aged 18–39 years had a significantly lower likelihood of having T2DM ($p < 0.001$). Overweight and obese PLHIV were 2.11 (95% CI: 1.23–3.63) and 3.89 times (95% CI: 2.30–6.56) more likely to have T2DM, respectively, compared to those with normal weight. Over one in six PLHIV in Texas had T2DM, with age and BMI being significant predictors [33].

In Cambodia, the MOH, in collaboration with development partners, has introduced a variety of interventions to ensure service availability. These interventions include the following:

A cross-sectional study conducted among 370 young PLHIV (YPLHIV) receiving care at three HIV clinics in Phnom Penh included both male and female participants aged 18 to 29 years who were HIV-positive and had a medical check-up visit during the study period (November 2019–February 2020). Additionally, 486 individuals from the general population were included. The study examined the prevalence of diabetes, hypertension, and high cholesterol in both groups and the relationship between these conditions and HIV. The results showed that 16 (4%), 22 (6%), and 72 (20%) YPLHIV had diabetes, hypertension, and high cholesterol, respectively, compared to 4 (1%), 22 (4%), and 49 (11%) in the general population. Logistic regression analysis indicated that YLWH had significantly higher odds of diabetes/prediabetes and high cholesterol compared with the young general population, with adjusted odds ratios (OR) of 6.64 (95% CI 3.62–12.19) and 7.95 (95% CI 3.98–15.87), respectively [34].

In a separate study on the prevalence of NCDs and related risk factors among PLHIV in Cambodia, it was found that the prevalence of diabetes mellitus was 9.4%. No statistical differences were observed in the prevalence of hypertension and diabetes mellitus between men and women [35].

IV. Objectives

4.1 General objective:

To estimate the magnitude of non-communicable diseases, Advanced HIV Disease, and access to diagnosis and treatment for People living with HIV (PLHIV) in Cambodia.

4.2 Specific objectives:

a. To estimate the proportion of study patients who are assessed for Advanced HIV disease based on CD4 cell count, WHO clinical staging criteria, cryptococcal antigen (CrAg), LF-LAM, or Xpert MTB/RIF.
b. To estimate the proportion of PLHIV diagnosed with AHD who received appropriate (OI) prophylaxis and other pharmacological treatment.
c. To estimate the proportion of PLHIV receiving ART who were screened for hypertension.
d. To estimate the proportion of PLHIV diagnosed with hypertension who had access to treatment.
e. To estimate the proportion of PLHIV receiving ART who were screened for Type 2 Diabetes Mellitus.
f. To estimate the proportion of PLHIV diagnosed with Type 2 Diabetes Mellitus who had access to treatment.

Research Questions:

a. What proportion of PLHIV with AHD accessed to treatment?
b. What proportion of PLHIV with hypertension have access to treatment?
c. What proportion of PLHIV with T2DM accessed to treatment?

V. Methods

5.1 Study design

This document utilized a cross-sectional design that involved a desk review of patient charts sourced from selected Antiretroviral Therapy (ART) sites. This approach facilitated the collection of necessary data, allowing for the description of key variable characteristics and the determination of the proportion of the population with Advanced HIV Disease, Type 2 Diabetes Mellitus, and hypertension. These measures directly address the specific objectives and research questions outlined in the documentation.

5.2 Sampling and sample size

Nine ART clinics were purposively selected. These included: 1) Pochentong, 2) Kampong Tralach, 3) Srey Santhor, 4) NCHADS 1, 5) Battambang (BTB), 6) Siem Reap (SRP), 7) Sotnikum (SNK), 8) Tbong Khmum, and 9) Serei Sophon.

The sample size was calculated using the formula: $n = Z2pq/d2$

Where:

n is the sample size,

Z is the standard score corresponding to 95% confidence level, Z = 1.96

p is the expected proportion of People living with HIV who accessed NCD services. p is set at 26%.

q is equal to 1-p = 74%.

d is the proportion of sampling error, which is set 5% confidence limit.

Substituting the values into the formula:

n = [(1.96)2*0.26*0.74] / (0.05)2 = 295.6, then the number was rounded up to 297 to 33 samples per selected ART clinic.

The calculated sample size was rounded up to 297, resulting in 33 samples per selected ART clinic.

Based on this calculation and the required sample size, 33 patient records/files were reviewed at each selected ART site. The patient records were randomly selected. All active records were eligible for the random.

5.3Data collection

A desk review method was employed for data collection. At each selected ART clinic, the data collection team randomly selected 33 patient charts of current ART clients aged 15 years and older. Pre-identified information of interest was reviewed and extracted using a standardized data abstraction form.

Table 1: Summary of Methods and Tools for Data Collection.

Specific Objective	Method of Data Collection	Tools
a. To identify the proportion of PLHIV in the ART services accessed to the package of diagnostics (CD4, CrAg, LF-LAM, or Xpert MTB/RIF) for AHD.	Desk review: The information on the selected patient records was reviewed and collected from enrollment in the ART service up to the last visit.	A standardized web-based abstraction form was used on five pre-configured tablets.
b. To identify the proportion of PLHIV diagnosed with AHD accessed to medicine/treatment.		
c. To determine the proportion of PLHIV in the ART services accessed to hypertension screening.		
d. To determine the proportion of PLHIV with hypertension accessed to treatment.		
e. To determine the proportion of PLHIV in ART services accessed to the screening for Type 2 Diabetes Mellitus.		
f. To determine the proportion of PLHIV with T2DM accessed to treatment.		

5.4 Data Review Process

After developing the web-based tool for data collection, the research team, including the AIDS Care team, reviewed the final version of the tool and tested it to ensure that it followed the skipping patterns and instructions. The team was built based on experience and expertise to ensure the proper flow of data.

Before the data collection, the following steps were done:
The data collection team was trained on both questionnaires and web-based tools for the data collection. Instructions and sources of data were explained to all data collectors.

The web-based tool was uploaded onto 5 tablets for data collection. The team prepared the logistical, administrative, and technical requirements necessary for conducting the data collection as planned.

Before the chart review took place at the selected ART site, the team held a meeting to briefly inform the provincial, hospital, and ART management teams about the purpose and objectives of the documentation and patient chart review.

At the ART site, two local coordinators supported our team in arranging logistics and administration, and ensuring the smooth flow of the patient chart review.
A total of 33 active charts were randomly selected from the file-keeping room. Confidentiality was always maintained at all levels.

The team was paired, with one person reading the chart and the other entering data into the tablet using the web-based tool. The reader also filled out a hard copy of the data collection tools, which would later be used to recheck the data and serve as a quality control measure.

At the end of each day, the nominated team coordinator reviewed the entered data, verifying it against the hard copy information. A small team meeting was held to discuss any issues, and resolutions were shared among the team to improve the process for the following day. After completing the patient chart review, a summary was provided to the ART team.
This process was repeated for each trip until the data collection was completed.

5.5 Data management

The collected data were coded, stored securely on the web, and kept in a confidential location accessible only to the study team. The data were cleaned, coded and analyzed by the research team of NCHADS. Data quality was ensured at all stages of the documentation process, including:
At the Data Collection Stage: An abstraction form was developed using a web-based tool and stored on a secure server. The team used four tablets for data collection. Each tablet required two data collectors: one to enter the data while the other read the information from the desk review. The process was monitored and supervised by a supervisor who ensured accuracy, consistency, and completeness.

At the Data Entry Stage: Double data entry was performed to ensure the integrity of the collected data. The data entry clerks entered the data twice and were alerted if the data were out of range or if they did not match.

5.6 Data analysis

Statistical analyses were performed using Stata software version 16.0. The mean and standard deviation were used to summarize continuous variables such as age, blood pressure values, HbA1c levels, etc. Proportions and frequency distributions were used for categorical data.
Descriptive statistics: Demographic and clinical characteristics of the study population, as well as the proportions of diabetes, T2DM, and cervical cancer, were generated.
Cross-tabulation was used to describe the relationship between two categorical variables, such as hypertension by age group, hypertension by sex, T2DM by age group, T2DM by sex, and so on.

VI. Ethical considerations

6.1 Risks or discomforts

This study, a retrospective chart review, involves minimal risk to patients. Data are extracted from existing medical records and involve no direct patient interaction; therefore, there is no associated physical, psychological, social, or economic discomfort.

6.2 Benefits

The findings reported in this document are expected to yield valuable insights that will assist the National Center for HIV/AIDS, Dermatology and STDs in optimizing program activities and enhancing care delivery for People living with HIV in Cambodia. Furthermore, these results should contribute to the development of strategies aimed at improving future access to services for both Advanced HIV Disease and non-communicable diseases within this population.

6.3 Confidentiality

To ensure the utmost confidentiality and protect participant privacy, no direct identifiers (such as names, addresses, or other personally identifiable information) were collected during the data abstraction process. All collected data were de-identified and assigned unique study codes. The de-identified data were stored securely in a locked facility and password-protected electronic databases, accessible only to authorized NCHADS team members who had signed formal confidentiality agreements.

VII. Results:

Operational Definition of Key Terms:

Advanced HIV Diseases (AHD)

As defined by the World Health Organization (WHO), AHD refers to a CD4 cell count of less than 200 cells/mm³ or the presence of WHO clinical Stage 3 or 4 conditions in adults and adolescents. All children under the age of five are considered to have AHD regardless of clinical or immunological status [1].

Noncommunicable Diseases (NCDs)

Also known as chronic diseases, NCDs are not transmitted from person to person. They are of long duration and generally progress slowly. The four main types—cardiovascular diseases, cancer, diabetes, and chronic respiratory diseases—represent a growing burden on global health and development [35].

This documentation focused specifically on two NCDs: **hypertension** and **type 2 diabetes mellitus:**

- **Hypertension:**
  Defined as systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg [36].

- **Type 2 Diabetes Mellitus:**
  Diagnosed based on WHO criteria using blood tests. A fasting plasma glucose level of ≥126 mg/dL (7.0 mmol/L) or a glycated hemoglobin (HbA1c) level of ≥6.5% (48 mmol/mol) is considered indicative of T2DM [37].

7.1 Socio-demographic characteristics of study patients

Table 2: Socio-Demographic Characteristics of Study Patients.

Variable	Category	Total patients (n=297)	
		Frequency	%
Sex	Male	164	55.22
	Female	133	44.78
Age Category (years)	15–24	28	9.43
	25–34	50	16.84
	35–44	77	25.93
	45–54	90	30.3
	≥55	52	17.51
Mean Age (± SD)		43 years (±12.5)	
Year of ART Initiation	< 2012	145	48.82

	2012–2016	49	16.5
	2017–2020	48	16.16
	2021–2024	55	18.52
Duration on ART	<5 years	63	21.21
	5–9 years	54	18.18
	≥10 years	180	60.61

Among 297 study participants, 44.78% were female and 55.22% were male, indicating a slightly higher proportion of males. Most participants (56.23%) were between the ages of 35 and 54 years. The mean age was 43 years (±12.5).

The document examined antiretroviral therapy (ART) initiation patterns among the participants. Nearly half (48.82%) initiated ART before 2012, representing the largest proportion. A notable decline in ART initiation occurred between 2012 and 2016, with only 16.5% starting treatment during this period. This trend remained relatively stable from 2017 to 2020, with 16.16% initiating ART. However, a modest increase was observed from 2021 to 2024, during which 18.52% of participants began treatment.

The analysis of ART duration revealed the distribution of treatment experience within the cohort. Approximately 21.21% of participants had been on ART for less than five years, while 18.18% had received treatment for five to nine years. Notably, the majority (60.61%) had been on ART for ten years or longer (see Table 2).

7.2 Clinical Characteristics of Study Patients

Table 3: Clinical Characteristics and Treatment Overview of Study Patients.

Variable	**Category**	**Total patients (n=297)**	
		Frequency	**%**
ART Regimen Distribution			
	DTG-based	277	93.27
	EFV-based	14	4.71
	PIs-based regimen	6	2.02
CD4 Baseline (cells/mm³)			
	<100	57	19.20

	100 – 199	30	10.10
	200 – ≤350	57	19.20
	>350	118	39.70
	Missing	35	11.80
Last (current) CD4 (cells/mm³)			
	<100	8	2.70
	100 – 199	9	3.03
	200 – ≤350	28	9.43
	>350	209	70.37
	Missing	43	14.48
Classifications WHO Stage			
	WHO stage 1	157	52.86
	WHO stage 2	17	5.72
	WHO stage 3	66	22.22
	WHO stage 4	37	12.46
	Missing	20	6.73
Last Viral Load			
	Undetected	276	92.93
	40 – <1000	7	2.36
	≥1000	5	1.68
	Missing	9	3.03
Received TPT prophylaxis (n=297)			
	Yes	262	88.22
	No	35	11.78
Eligible for Cotrimoxazole prophylaxis* (n=297)			
	Yes	184	61.95
	No	113	38.05
Received Cotrimoxazole prophylaxis (n=184)			
	Yes	110	59.78

	No	74	40.22
Eligible for Fluconazole prophylaxis (n=297)**			
	Yes	57	19.20
	No	240	80.80
Received Fluconazole prophylaxis (n=57)			
	Yes	36	63.16
	No	21	36.84

Among 297 patients in this document, a striking majority 93.27% were on a Dolutegravir (DTG)-based ART regimen. In contrast, only a small proportion were receiving Efavirenz (EFV)-based 4.71% or Protease Inhibitor (PI)-based 2.02% regimens.

At baseline, 29.30% of patients showed advanced immunosuppression, meaning their CD4 counts were below 200 cells/mm³. More precisely, 19.20% had very low CD4 counts (less than 100 cells/mm³), and 10.10% had counts between 100 and 199 cells/mm³.

In contrast, a large group, 39.70%, started with CD4 counts above 350 cells/mm³, while 19.20% had counts ranging from 200 to 350 cells/mm³. It is worth noting that 11.80% of the baseline CD4 data was missing.

The most recent CD4 counts reveal marked immune recovery within the cohort. A remarkable 70.37% of patients now have CD4 counts exceeding 350 cells/mm³, representing a significant improvement from baseline. Only a small fraction, 2.70%, currently maintains CD4 counts below 100 cells/mm³, indicating successful immune reconstitution in the majority. Additionally, 9.43% had counts between 200 and 350 cells/mm³. However, 14.48% of the current CD4 data remained unavailable.

According to the World Health Organization (WHO) clinical staging criteria, over half of the patients (52.86%) were classified as WHO stage 1. Conversely, a considerable proportion of the cohort presented with advanced clinical manifestations, with 22.22% in Stage 3 and 12.46% in Stage 4. Missing data accounted for 6.73% of the WHO staging information.

The cohort demonstrated excellent outcomes regarding virological control, achieving a suppression rate of 92.93% (undetectable viral load). Only a small minority had detectable viral loads, with 2.36% showing between 40–<1000 copies/mL and 1.68% having ≥1000 copies/mL. Missing viral load data was minimal at 3.03%.

Regarding tuberculosis preventive therapy (TPT), 88.22% of patients received TPT, reflecting high coverage; however, 11.78% did not receive it. Of the total cohort, 184 patients (61.95%) were eligible for cotrimoxazole prophylaxis. However, among these eligible individuals, only 59.78% (n=110) received the prophylaxis, while 40.22% remained untreated. Additionally, 57 participants (19.20%) were eligible for

fluconazole prophylaxis. Among these eligible patients, 63.16% (n=36) received Fluconazole prophylaxis, and 36.84% did not (see Table 3).

7.3 The proportion of study patients assessed for AHD was determined based on CD4 cell count or WHO clinical staging criteria

Table 4: The frequency and proportion of study patients classified with Advanced HIV disease according to CD4 count or WHO clinical staging.

Classification	WHO Stage	Total patients (n=297)			
		CD4 < 200 cells/mm³	CD4 ≥ 200 cells/mm³	No CD4 Data	Total (n=297)
		n (%)	n (%)	n (%)	n (%)
AHD	No WHO Stage	1 (0.34)	-	-	1 (0.34)
	Stage I	7 (2.35)	-	-	7 (2.35)
	Stage II	2 (0.67)	-	-	2 (0.67)
	Stage III	6 (2.02)	57 (19.19)	3 (1.02)	66 (22.23)
	Stage IV	1 (0.34)	34 (11.44)	2 (0.67)	37 (12.45)
	Total AHD	**17 (5.72)**	**91 (30.63)**	**5 (1.69)**	**113 (38.04)**
None AHD	No WHO Stage	-	13 (4.38)	6 (2.02)	19 (6.40)
	Stage I	-	120 (40.41)	30 (10.10)	150 (50.51)
	Stage II	-	13 (4.37)	2 (0.67)	15 (5.04)
	Stage III	-	-	-	-
	Stage IV	-	-	-	-
	Total None AHD	**0 (0.00)**	**146 (49.16)**	**38 (12.80)**	**184 (61.95)**
Overall Total (n=297)		**17 (5.72)**	**237 (79.79)**	**43 (14.49)**	**297 (100.00)**

The document describes a cohort of 297 patients whose Advanced HIV Disease status was evaluated based on two criteria: immunological measures and clinical indicators (WHO staging). A notable proportion of

the cohort, specifically 38.04% (n=113), met the criteria for AHD. Within this AHD-classified group, a substantial segment, 30.63% (n=91) of the total cohort, presented with CD4 cell counts at or above 200 cells/mm³. This finding is significant because it suggests that for these patients, the AHD classification was primarily driven by their advanced WHO clinical stage (Stage 3 or 4), rather than solely by a low CD4 count.

A smaller subset, 5.72% (n=17) of the overall cohort (and consequently part of the AHD group), had CD4 cell counts below 200 cells/mm³, which is a direct immunological criterion for AHD.

Furthermore, 1.70% (n=5) of the patients classified with AHD had no CD4 count data available. Crucially, all of these patients were assigned to AHD due to their classification in WHO clinical Stage 3 or 4.
The remaining 61.96% (n=184) of the study cohort were classified as having Non-Advanced HIV Disease (see Table 4).

Table 5: Socio-Demographic and treatment characteristics of study population with AHD.

Variables	**Category**	**Total patients (n=113)**	
		Frequency	**%**
Sex			
	Female	52	46.02
	Male	61	53.98
Age group			
	15–24	5	4.42
	25–34	11	9.73
	35–44	28	24.78
	45–54	47	41.60
	≥55	22	19.47
Mean Age (± SD)		46.9 years (±11.0)	
ART Regimen			
	DTG-based	104	92.04
	EFV-based	6	5.31
	PIs-based	3	2.65

Year of ART Initiation			
	Before 2012	69	61.06
	2012–2016	26	23.01
	2017–2020	6	5.31
	2021–2024	12	10.62

Among the 113 study patients classified with AHD, the sex distribution showed a slightly higher proportion of males (54%) compared to females (46%). The mean age of the patients was 46.9±11.0 years. Regarding age group distribution, the largest proportion of patients fell within the 45-54 years category (41.60%), followed by 35-44 years (24.78%) and ≥55 years (19.47%).

Regarding antiretroviral therapy (ART) regimens, a significant majority of patients (92.04%) were on a DTG-based ART regimen, with EFV-based and PIs-based regimens constituting a very small minority, at 5.31% and 2.65%, respectively.

Most patients (61.06%) initiated ART prior to 2012, indicating a long-term cohort. In contrast, ART initiation was less frequent in subsequent periods, with 23.01% starting between 2012-2016, 5.31% between 2017-2020, and 10.62% between 2021-2024.

7.4 The proportion of AHD patients who access opportunistic infection (OI) prophylaxis and preventive treatment

Table 6: Number and Percentage of study patients with AHD accessing to hypertension treatment.

Variable	**Total patients (n=113)**		
	Category	**Frequency**	**%**
Received TPT prophylaxis			
	Yes	101	89.38
	No	12	10.62
Received Cotrimoxazole prophylaxis			
	Yes	64	56.64
	No	49	43.36
Eligible for Fluconazole prophylaxis			

	Yes	8	7.08
	No	105	92.92
Received Fluconazole prophylaxis (n=57)			
	Yes	4	50.00
	No	4	50.00

Among 113 study patients with AHD, access to preventive treatments was assessed. Tuberculosis Preventive Therapy (TPT) was received by 89.38% of patients, while 10.62% did not receive TPT. Regarding cotrimoxazole prophylaxis, 56.64% of eligible patients received the treatment, whereas 43.36% did not. Only 7.08% of patients were eligible for fluconazole prophylaxis, with the majority (92.92%) not eligible. Among the eligible patients (n=8), 50.00% received fluconazole prophylaxis, and 50.00% did not (Table 6).

Table 7: Number and percentage of study patients with AHD accessing health facility-based treatment.

Health Facility-Base Treatment	**Received PTP (n=113)**		**Received Cotrimoxazole (n=113)**		**Received Fluconazole (n=8)**	
	Frequency	%	Frequency	%	Frequency	%
In ART Clinic	**101**	89.38	**64**	56.64	**4**	50.00
Referred to Other Service	0	0.00	0	0.00	0	0.00
Private	0	0.00	0	0.00	0	0.00
Unknown	0	0.00	0	0.00	0	0.00

All AHD patients who receive TPT, cotrimoxazole, and fluconazole prophylaxis obtain these treatments exclusively at the ART clinic (Table 7).

7.5 The proportion of study patients who were assessed for hypertension screening

Table 8: Number and Percentage of study patients accessing hypertension screening.

Variables	**Category**	**Frequency**	**Percentage (%)**
Hypertension Screening		Total patients (n=297)	

	Screened	284	95.6
	No documented BP measurements	13	4.4
BP Measurement Result		Total patients (n=284)	
	BP (<140/90 mmHg)	274	96.5
	BP (>140/90 mmHg)	**10**	**3.5**

Out of 297 study patients, 95.6% (284 patients) were screened for hypertension, while 4.4% (13 patients) were not screened. Among those screened, 96.5% (274 patients) had normal blood pressure (below 140/90 mmHg), and 3.5% (10 patients) had high blood pressure (above 140/90 mmHg) (Table 8).

7.6 The proportion of Hypertension patients who access treatment

Table 9: Number and Percentage of Study Patients accessing to hypertension treatment (n=297).

BP Measurement	**Treatment Status**			
	No treatment		**On treatment**	
	Frequency	%	Frequency	%
BP (>140/90 mmHg)	-	-	**10**	3.37
BP (<140/90 mmHg)	264	88.89	**10**	3.37
No documented BP measurements	11	3.7	**2**	0.67
Total	275	92.59	**22**	7.41

Among 297 study participants, blood pressure (BP) measurements were available for 284 individuals (95.63%). Of these, 10 patients (3.37%) had elevated BP readings (>140/90 mmHg), all of whom were receiving antihypertensive treatment. Among the 274 participants (92.26%) with normal BP levels (<140/90 mmHg), 10 individuals (3.37%) were also on antihypertensive medication, possibly due to a previous diagnosis of hypertension. Additionally, 2 patients (0.67%) who had no recorded BP measurements were receiving treatment. In total, 22 patients (7.41%) across the study cohort were on antihypertensive therapy (see Table 9).

Table 10: Number and percentage of study patients with HTA accessing health facility-based treatment.

Health Facility-Based Treatment Type	Total patient (n=22)	
	Frequency	%
Treatment at ART clinic (same facility)	9	40.90
Referred to another service (same facility)	3	13.60
Private healthcare	2	9.10
Unknown	8	36.40
Total	**22**	**100**

Among the 22 patients receiving antihypertensive treatment, 40.9% accessed care directly through the ART clinic within the same facility. A smaller proportion (13.6%) were referred to another service within the same facility, while 9.1% received care from private healthcare providers. For 36.4% of the patients, the treatment location was either undocumented or unknown (see Table 10).

7.7 The proportion of study patients who were assessed for Type 2 Diabetes Mellitus screening

Table 11: Number and Percentage of PLHIV accessed type 2 diabetes Mellitus screening.

Variables	Category	Frequency	Percentage (%)
T2DM Screening		Total patients(n=297)	
	Screened	37	12.5
	No documented screening	260	87.5
FBG or HbA1c Measurement Result		Total patients(n=37)	
	FBG (≤126 mg/dL)	27	72.97
	FBG (≥126 mg/dL)	**6**	**16.21**
	FBG (≥126 mg/dL) and HbA1c level (≥6.5)	4	10.81

Out of 297 patients in the study, only a small portion, 12.5% (37 patients), were tested for type 2 diabetes, while the majority, 87.5% (260 patients), were not screened.

Among those screened, most patients (73%) had normal blood sugar levels based on fasting blood glucose measurements. However, about 16% showed high blood sugar levels, and roughly 11% had both high fasting blood sugar and elevated HbA1c, indicating possible diabetes or poor blood sugar control (Table 11).

7.8 The proportion of Type 2 Diabetes Mellitus patients who access treatment

Table 12: Number and Percentage of Study Patients accessing to type 2 diabetes Mellitus treatment (n=297).

Glycaemic Category	Treatment Status			
	No treatment		On Treatment	
	Frequency	%	Frequency	%
FBG (≤126 mg/dL)	**27**	9.10	-	-
FBG (≥126 mg/)	-	-	**6**	2.02
FBG (≥126 mg/dL) and HbA1c level (≥6.5)	-	-	**4**	1.35
No documented screening	258	86.86	**2**	0.67
Total	285	95.96	**12**	4.04

Among 297 study participants, only 12.5% (n = 37) had documented screening for Type 2 Diabetes Mellitus. Of those screened, 6 patients (2.02%) had elevated fasting blood glucose (FBG) levels (≥126 mg/dL), and 4 patients (1.35%) had both elevated FBG (≥126 mg/dL) and HbA1c levels ≥6.5%; all were receiving treatment for T2DM. Additionally, 2 patients (0.67%) who had no documented T2DM screening were also receiving treatment. In total, 12 patients (4.04%) in the cohort were on treatment for type 2 diabetes mellitus (see Table 12).

Table 13: Number and percentage of study patients with type 2 diabetes Mellitus accessing health facility-based treatment.

Health Facility-Based Treatment Type	Total patient (n=12)	
	Frequency	Percentage (%)
Treatment at ART clinic (same facility)	2	16.7
Referred to another service (same facility)	4	33.3
Private healthcare	1	8.3
Unknown	5	41.7
Total	**12**	**100**

Among 12 study patients receiving treatment for Type 2 Diabetes Mellitus, 16.7% (n = 2) received care at the ART clinic within the same facility. One-third of patients (33.3%, n = 4) were referred to another service within the same facility, while 8.3% (n = 1) accessed private healthcare. For 41.7% of patients (n = 5), the treatment location was not documented or remains unknown (Table 13).

VIII. Discussion

This document provides critical insights into the comprehensive management strategies for People living with HIV. Specific areas addressed include the use of antiretroviral therapy, appropriate prophylactic interventions, and the management of associated comorbidities such as advanced HIV disease and non-communicable diseases, notably hypertension and Type 2 Diabetes Mellitus. AHD was assessed through both immunological (CD4 count) and clinical (WHO staging) criteria. Findings revealed that 38% of the cohort met the criteria for AHD, indicating a significant burden of late HIV presentation. This underscores the ongoing need for early diagnosis, prompt linkage to care, and targeted strategies for individuals at risk of advanced disease [38].

The document highlights a critical weakness in current screening protocols: zero participants were subjected to either LF-LAM or CrAg testing. The omission of these essential diagnostics is particularly concerning given their crucial role in detecting high-mortality opportunistic infections, such as TB, commonly associated with AHD. This diagnostic deficiency suggests missed opportunities for timely intervention, potentially contributing to adverse clinical outcomes.

Assessment of treatment access among PLHIV with AHD revealed further deficiencies in prophylactic care. Coverage rates were suboptimal: only 56.64% received cotrimoxazole, 50% received fluconazole, and 89.38% received TPT. These figures suggest missed opportunities to prevent life-threatening infections.

These gaps reflect systemic challenges such as medication stockouts, poor clinical follow-up, delayed detection of opportunistic infections, and inconsistent implementation of national care guidelines. The lack of timely and comprehensive prophylaxis exposes patients to preventable complications, worsening outcomes for this high-risk population [39].

All prophylactic treatments for AHD patients were administered exclusively through the ART clinic within the same facility, with no referrals or private-sector involvement reported.

This document demonstrates notable progress in integrating NCD services into HIV care. Hypertension screening was conducted for 95.6% of PLHIV, indicating effective implementation of routine blood pressure monitoring. However, 4.4% of patients were not screened, highlighting a gap in achieving universal coverage.

Among those screened, 3.5% had high blood pressure (≥140/90 mmHg). This is significantly lower than 15% hypertension prevalence reported in a Cambodian study on NCDs among PLHIV [9]. While the lower prevalence may reflect differences in population or methodology, it underscores the need for ongoing surveillance and integrated hypertension management, especially as the HIV-positive population ages and NCD risk increases.

Interestingly, among 92.3% of patients with normal BP readings (<140/90 mmHg), 3.5% were already on antihypertensive medication—suggesting a history of hypertension and ongoing management. Additionally, 0.7% (2 patients) with no recorded BP measurement were also on treatment. In total, 7.4% (22 patients) of the cohort were receiving antihypertensive therapy.

Regarding access to treatment, 40.9% of patients on antihypertensive medication received care directly at the ART clinic, 13.6% were referred to other in-facility services, and 9.1% sought care from private providers. For 36.4% of patients, the location of care was undocumented or unknown, indicating potential issues in record-keeping and adherence to clinical protocols.

Similar challenges have been observed in Uganda, as documented in the study by Martin Muddu et al., which explored barriers to integrated hypertension-HIV care using the Consolidated Framework for Implementation Research (CFIR). Key barriers included limited resources, inadequate documentation, and non-functional blood pressure monitoring equipment [40].

The present document unequivocally highlights a substantial diagnostic gap in the routine screening for Type 2 Diabetes Mellitus among PLHIV. With a strikingly low screening rate of only 12.5% (37 out of 297 patients underwent T2DM screening), compared to 87.5% who were not tested, our findings underscore a significant shortfall in current HIV care practices regarding metabolic health monitoring. This limited screening likely contributes to the underdiagnosis of T2DM within this vulnerable population.

This diagnostic oversight is particularly concerning given the well-established increased risk of T2DM among PLHIV. Factors contributing to this heightened risk include the chronic inflammation associated with HIV infection itself, the metabolic side effects of certain antiretroviral therapies (ART), and shared traditional risk factors such as age, obesity, and lifestyle [41, 42]. Undiagnosed and untreated T2DM can lead to severe microvascular and macrovascular complications, including cardiovascular disease, nephropathy, retinopathy, and neuropathy, thereby significantly increasing morbidity, mortality, and healthcare costs for PLHIV [43]. The observed prevalence of elevated blood glucose (16%) and confirmed T2DM (11%) among the small subset that was screened further suggests that the true burden of T2DM in this cohort, and potentially in the broader PLHIV population, is likely underestimated due to insufficient screening. This aligns with recent studies that continue to report a high burden of undiagnosed or undertreated NCDs, including T2DM, in PLHIV cohorts, particularly in low- and middle-income countries [44, 45].

The observed low screening rate could be attributed to several factors prevalent in many healthcare settings. These may include limited access to laboratory facilities capable of performing fasting blood glucose and HbA1c tests, insufficient training of healthcare providers on the importance and methods of T2DM screening in PLHIV, lack of dedicated time for comprehensive metabolic assessments during routine HIV clinic visits, or an overarching focus on viral suppression and opportunistic infection management that overshadows NCD screening. Furthermore, patient awareness regarding their increased risk of T2DM may also be low, reducing demand for screening [10].

These findings underscore a missed opportunity to address a significant non-communicable disease (NCD) that, if left undiagnosed and unmanaged, can compound HIV-related health complications. Although only a small proportion of participants underwent T2DM screening, the results clearly demonstrate that some PLHIV are at risk for or currently living with diabetes. This reinforces the need for routine, systematic screening for T2DM as part of comprehensive HIV care.

A key finding was the diagnostic gap observed in the cohort, evidenced by 0.67% of PLHIV identified with T2DM who had not undergone appropriate screening with FPG or HbA1c testing. This non-adherence to diagnostic protocol raises concerns and suggests potential systemic barriers, including limited patient access, inconsistent physician adherence to established screening guidelines, or deficiencies in medical documentation.

Access to treatment for PLHIV diagnosed with T2DM further reveals disparities in care delivery and coordination. Only 16.7% of affected individuals received treatment within the ART clinic, indicating underutilization of integrated service models where HIV and diabetes care can be co-managed. One-third were referred to other services within the same facility, reflecting some level of coordination but also potential care fragmentation. A small proportion (8.3%) sought treatment from private healthcare providers, pointing to diverse care-seeking behaviours.

Notably, for 41.7% of patients, the location of diabetes treatment was undocumented or unknown highlighting serious shortcomings in patient tracking, record-keeping, and monitoring of chronic comorbidities. These findings are consistent with previous research illustrating the challenges PLHIV face when navigating multi-specialty care systems, especially in managing concurrent chronic conditions such as HIV and diabetes [46].

IX. Conclusion and recommendation

Conclusion

This document aimed to assess the burden of Advanced HIV Disease, hypertension, and type 2 diabetes mellitus among PLHIV, alongside their access to appropriate screening, treatment, and prophylactic interventions. The findings revealed that 38 % of PLHIV presented with AHD, while 3.5% and 27% were

diagnosed with hypertension and T2DM, respectively. These results underscore the considerable comorbidity burden in this population and highlight the critical need for integrated care services.

Despite the availability of treatment options, access to prophylaxis and chronic disease management remains inadequate particularly in addressing non-communicable diseases. The relatively high prevalence of hypertension and diabetes among PLHIV underscores the importance of incorporating routine, systematic screening, and management of NCDs into HIV care. Additionally, the availability and consistent utilization of CD4 testing for the identification and management of AHD should be reinforced at all levels of healthcare delivery.

A key limitation of this study was the presence of missing data, which may have affected the accuracy of prevalence estimates and treatment coverage. Future research should prioritize improving data completeness and quality to enable more reliable monitoring and better-informed clinical and policy decisions.

In conclusion, the findings highlight the urgent need for a more comprehensive and integrated approach to HIV care one that includes the routine screening, prevention, and management of both opportunistic infections and NCDs. Strengthening health systems to support these integrated services is essential to improving long-term health outcomes for PLHIV.

Recommendations

Addressing gaps in screening, treatment, and care coordination is essential to improving health outcomes for PLHIV. The national HIV program should prioritize the following key areas:

a. Strengthen Prophylaxis and Diagnostic Testing

Expand the coverage of essential prophylactic interventions—such as tuberculosis preventive therapy (TPT), cotrimoxazole, and fluconazole particularly for individuals with Advanced HIV Disease. Prioritize routine screening for opportunistic infections to enable early detection and prompt treatment, thereby reducing the risk of severe and potentially fatal complications.

b. Enhance Routine Screening for Comorbidities

Integrate regular screening for opportunistic infections and non-communicable diseases, including hypertension and type 2 diabetes, into routine HIV care. Early identification and management of these conditions are crucial to preventing long-term complications that can further compromise the health of PLHIV.

c. Strengthen Health Information Systems for Enhanced Data Quality

To ensure comprehensive and accurate data for tracking disease burden, treatment coverage, and health outcomes in HIV care programs, health information systems must be strengthened. High-quality data are

essential for informed decision-making, targeted interventions, and improved accountability. A key initiative to achieve this is providing specific refresher training on the proper use of patient forms (Forms A, A1, A2, B, and Summary Form).

d. Strengthen Referral Pathways and Care Coordination

Improve coordination between HIV clinics and other health service units to facilitate timely referrals and ensure continuity of care. Strengthening integrated service delivery models will help address the multifaceted needs of PLHIV more effectively.

e. Build Capacity and Support for Healthcare Providers

Provide ongoing training, mentorship, and resources to healthcare providers to improve clinical management, ensure adherence to national guidelines, and enhance the delivery of integrated HIV and NCD care.

X. Limitation

This study had several limitations that may have affected the comprehensiveness of its findings:

1. **Incomplete Data:**

   The absence of complete treatment records from initial assessments and follow-up visits limited the ability to fully evaluate the management of tuberculosis and cryptococcal infections. These data gaps hinder a comprehensive understanding of disease progression and the effectiveness of interventions.

2. **Limitation in Follow-up and Monitoring:**

   The study identified weaknesses in patient follow-up and tracking systems, which may have contributed to missing data on treatment adherence and clinical outcomes. These limitations affect the reliability of conclusions regarding the overall effectiveness of care and management strategies.

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