Evaluation Report

Identifying sustainable interventions for HIV epidemic control in lower eastern region in Kenya

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Centre for Health Solutions - Kenya

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DISCLAIMER

The findings and conclusions in this report are those of the author(s) and do not necessarily represent the official position of the funding agencies.

Executive Summary

Background

Several guidelines exist that address HIV testing and linkage services including self-testing to facilitate achievement of the first 90 target before introduction of the current first 95 target. A defined standard package of care for persons living with HIV (PLHIV) was adopted including universal access to antiretroviral therapy (ART) for children, adolescents and adults to support the achievement of the second 90 target. Guidance also included innovative patient-centered models to support adherence and retention, such as differentiated care approaches at facility and community level to support the achievement of the third 90 target. However, not much is known about the implementation of these interventions in resource limited settings, particularly in Machakos, Makueni and Kitui counties of lower eastern region in Kenya where the CHS Naishi project was implemented. This evaluation sought to document and assess the various public health interventions and strategies employed along the 90-90-90 cascade of identification, antiretroviral treatment and viral suppression, and other patient outcomes in the three counties supported by CHS-Naishi.

Methods

The purpose of this evaluation was to utilize routinely collected health facility as well as administrative information to identify and document sustainable interventions for HIV epidemic control in CHS Naishi project-supported health facilities in Machakos, Makueni and Kitui counties. Descriptive, bivariate and regression analysis were done to document HIV testing and outcomes of patients on ART including viral suppression, mortality, and loss to follow up (LTFU).

Key Findings

HIV Testing Services

The peak of HIV testing and identification from Quarter 4 of 2017 to Quarter 2 of 2018 coincided with the HIV testing services (HTS) surge in the three Naishi counties when additional resources were availed to recruit and deploy additional HIV testing counsellors. Additional investment came at a time

when the project had adequate amounts of HIV test kits that enabled mass testing in various departments especially in the out-patient department (OPD). The decline thereafter was as a result of withdrawal of the additional resources and investments for the HTS surge and introduction of the HTS optimization initiative which focused on strategies such as HTS eligibility screening in OPD to identify and test those at significant HIV risk, assisted partner notification services, family testing, testing for TB and those malnourished. This new identification strategy was opportune at the time, and the country at large, experienced a reduction in key resources for mass testing such as HIV rapid test kits and HTS providers. The same trend was noted in the HIV positive identification and linkage, showing a proportionate contribution of testing to identification of positive individuals in the region. The HTS positives identified in in-patient department (IPD)vary by the nature of hospital admissions at any given time. There were confounding factors that affected HIV testing during the period such as industrial action of health workers and COVID-19 epidemic which reduced health facility workload in and ultimately HIV testing services in some period of the project . The institutionalization of eligibility screening at facility entry points in the outpatient departments also saw increasingly less numbers of clients receiving an initial HIV test in the IPD thus leading to less numbers identified in that department. The majority of newly identified patients were linked to the comprehensive care clinic (CCC) within the same facility of identification and initiated on ART.

Antiretroviral Therapy

The majority of clients on ART were females and adults. Most of the clients had a WHO stage 1 at baseline, an indication that clients were identified with HIV at an early stage. Over half were on the TDF baseline and current core regimen. Most clients were virally suppressed at current viral suppression and very few had a documented comorbidity or chronic illness due to high viral load suppression and adherence to medication.

HIV Treatment Outcomes

Viral Load

Characteristics associated with viral load suppression were being female, adults above 35 years, married, HIV WHO stage 1& 2 at baseline, Tenofovir disoproxil fumarate (TDF) current core regimens. A higher proportion of current non-suppressed clients were non-suppressed at the beginning of program implementation. Characteristics associated with viral non-suppression were being male sex, age categories 0-34 years, never married or with unknown marital status,

underweight, HIV WHO stage 3, 4 or un-staged, Abacavir (ABC), Azidothymidine (AZT) as core baseline and current regimens, and those on ART for 7-12 months.

Lost to Follow-up results

Age categories aged 10-14, 15-19, 45-54, and 55-64 were significantly associated with a higher risk of being LTFU. Men have been shown to have a higher risk of LTFU than women. Those with advanced disease in HIV WHO Stage 3 and with a higher viral load of above 1000 were highly likely to be associated with LTFU.

Mortality

The characteristics associated with higher risk of mortality among HIV positive clients were: being male, ages 55 to 64 and 65 years, those not married or in polygamous relationships, those with un-staged HIV WHO, stage 3 and stage 4, underweight body mass index (BMI), non-suppressed or unknown viral suppression status at both baseline and currently compared to those who were suppressed; and other current core based regimen compared to TDF based core regimen.

Key Considerations

1. Outpatient department (OPD) HTS optimization through HTS eligibility screening to achieve testing efficiency.
2. Continue to target high yielding HTS strategies like ethical assisted Partner Notification Services (aPNS) to increase the elicitation ratio, high identification of positives through index testing.
3. Conducting CQI project for children identification could increase the number of HIV positive children identified.
4. Periodic performance tracking using mobile technology to ensure close monitoring of HIV testing, identification positives, and ART initiation.
5. Periodic data review per county, facility, and even individual HTS counselors to monitor progress against time and institute immediate remedial actions on gaps identified.
6. One on one mentorship with HTS counselors through role plays to improve quality of HTS eligibility screening and elicitation.

7. Optimized rescreening among newly enrolled, High Viral Load (HVL), prevention of mother-to-child transmission (PMTCT) and adolescent and young people to identify sexual contacts for testing.
8. Implementation of strategies to reach men for HIV testing and linkage to ART through distribution of HIV self-test kits to men, employing the Social Network Strategy to reach friends of men who test HIV positive in the facilities, and engaging antenatal care mothers to bring partners for testing.
9. Same day initiation of ART to the newly identified to improve linkage.
10. Engagement with the Counties on continuous provision of personal protective equipment (PPE) to the HTS counsellors.
11. Capacity building of HTS counsellors on importance of wearing PPEs and maintaining social distancing to avoid interruption of services.
12. Proper utilization of eHTS tool to provide real time data for HTS and institution of immediate action plans.
13. Improve appointment management & reporting through use of electronic medical record (EMR) system.
14. Engagement of KENAPOTE (Teachers living with HIV) to support learners with HIV.
15. Collaborate with OVC partner to trace LTFU children and adolescents.
16. Integration of HIV, TB and COVID screening to avoid missed opportunities
17. Profiling clients by age, socioeconomic status and level of social support to help offer appropriate retention support e.g. spacing of facility visit appointments
18. Offer newer ART regimens for sustained viral suppression.

Lessons Learnt

1. OPD HTS eligibility screening contributes significantly in HTS efficiency.
2. Optimization of safe and ethical index testing has significantly contributed to positive identification.
3. Adequate counselling before and after HIV testing to address stigma and fear associated with HIV diagnosis.
4. Weekly performance tracking is key in monitoring performance of key indicators per facility and enables speedy feedback on recommendations for gaps identified.

5. One on one mentorship with HTS counselors, clinical officers, nurses, and health records officers through role plays to improve on quality of patient care and documentation helped to improve all aspects of the program.
6. Optimized rescreening among newly enrolled, HVL, PMTCT and adolescent and young people has enabled identification of sexual contacts for HIV testing.
7. Active engagement of County health management team (CHMT)/ Sub-county health management team (SCHMT) /facility in charges on importance of targeted HTS testing, quality of patient, and documentation improves ownership of HIV programming
8. Flexi/extended hours clinics offer clients extra time to access clinic where they were unable to attend during official working hours, thus improving retention.
9. Implementation of same day initiation increases the linkage of clients who are newly identified and is effective when done before an official transfer out to another facility. The use of the national health facility directory enables complete referrals to other facilities.
10. Structured treatment literacy classes improve client's knowledge about HIV and self-care and is a strategy to improve retention and better patient outcomes.
11. Patient follow-up through phone calls and physical tracing enables tracking and increases the number of clients returning to care.
12. Documenting clients phone contacts and physical address for easy follow-up
13. Timely investigation for the TB presumptive client and timely ART initiation for those diagnosed with TB.
14. Weekly tracking of unlinked positives and institution of site/officer specific remedial actions.
15. The project was able to reduce missed appointments through implementing patient centered Multi Month Dispensing, initiating community & facility ART groups, facility level audits of patient attrition with targeted interventions, appointment reminders using T4A, targeted physical tracing of LTFU clients, and collaboration with OVC partners for defaulter tracing of children and adolescents missing appointments.
16. Some strategies implemented to improve uptake and viral suppression among children and adolescents such as DOTs for children with viremia, NimeCONFIRM, audio and physical DOTS, enhanced adherence counselling for caregivers and unstable clients in papa and mama (PAMA) care and (Operation Triple Zero (OTZ).
17. To improve retention among children and adolescents, the engagement of PAMA and adolescents and youn people (AYP) champions for immediate tracing of children and

adolescents living with HIV who miss appointments, realignment of clinic appointments with school calendar, and collaboration with orphaned and vulnerable children (OVC) partner to trace LTFU children and adolescents yielded positive results.

18. There is room for early and improved TB diagnosis among clients in care.
19. There is minimal documentation of other chronic illnesses and co-morbidities among clients in care which may lead to insufficient information necessary for patient monitoring.

TABLE OF CONTENTS

ACRONYMS

Acronym	Meaning
ABC	Abacavir
ADT	ARV dispensing tool
AES	Advanced Encryption Standard
AIDS	Acquired immune deficiency syndrome
ANC	Antenatal care
aPNS	assisted Partner Notification Services
ART	Antiretroviral therapy
ARV	Antiretroviral (drugs)
aSHR	Adjusted Sub Hazard Ratio
AYP	Adolescents and Young People
AZT	Azidothymidine
BMI	body mass index
C-PAD	CCC patient application database
CASCO	County AIDS and STI coordinator
CBO	Community-based organizations
CCC	Comprehensive care clinic
CDC	Centre for Disease Control and prevention
CHMT	County Health Management Team
CHS	Centre for Health Solutions
CHV	Community health volunteers
CSO	Civil society organizations

Acronym	Meaning
EMR	Electronic Medical Records
HCW	Health Care Worker
HIV	Human Immunodeficiency virus
HRIO	Health Records Information Officer
HTS	HIV testing services
HVL	High Viral Load
IPD	In-Patient Department
IRB	Institutional review Board
IQI	Interquartile Interval/Range
KENPHIA	Kenya Population-based HIV Impact Assessment
M&E	Monitoring and Evaluation
MOH	Ministry of health
NACC	National AIDS Control Council
NASCOP	National AIDS control program
OTZ	Operation Triple Zero
OPD	Our-Patient Department
PAMA	Papa and mama
PEPFAR	President's Emergency Plan for AIDS Relief
PI	Principal Investigator
PLHIV	People living with HIV
PMTCT	Prevention of Mother to child transmission of HIV

DOTS	Directly Observed Therapy		TB	Tuberculosis
DHIS	District health information system		TDF	Tenofovir disoproxil fumarate
DHIS2	District Health Information Software-version2		TLD	Tenofovir, Lamivudine, and Dolutegravir
DTG	Dolutegravir		UNAIDS	The Joint United Nations Programme on HIV/AIDS
D4T	Stavudine		WHO	World health organization

INTRODUCTION

1. BACKGROUND

The global Human Immunodeficiency Virus (HIV) response has been catalyzed by the fast-track approach towards epidemic control by 2030. Through this approach, the Joint United Nations Program on HIV/AIDS (UNAIDS) aims to incrementally avert 17.6 million HIV infections and 10.8 million AIDS-related deaths between 2016 and 2030. In 2016, there was a 48% global decline in AIDS related deaths from a peak of 1.9 Million deaths in 2005, an achievement largely attributed to the global scale up of antiretroviral therapy (ART) coverage (UNAIDS, 2017). In the same period, eastern and southern Africa regions that bear the highest HIV burden, with an estimated 19.4 million adults and children living with HIV, had the highest gains achieving 60% ART coverage (from 24% in 2010) (UNAIDS, 2017).

At the beginning of the evaluation period, Kenya had the fourth largest HIV epidemic in Africa with an estimated 1.5 million PLHIV in 2015. Adult prevalence ranged from 5.6% - 6% (5.6%: KAIS 2012, ages 15-64 and 6%: NACC, 2014, ages 15-49) with incident infections estimated at over 71,000 among adults and 6,600 among children (NACC, 2016). The new infections were predominantly sexually transmitted (93.7%) among adults mostly affecting heterosexual couples in unions, key populations and young women aged 15 – 24 years (44%, 30% and 21% respectively; NASCOP 2015). Nationally, HIV-related mortality is estimated at 29% of total deaths (maternal and children under 5 years estimated at 20% and 15% respectively), although a recent mortuary surveillance study found a rate of 12.6% in Nairobi (NASCOP, 2016). More recent data during the evaluation period from Kenya Population-based HIV Impact Assessment (KENPHIA) survey in 2018 survey estimated that there are 1.3 million PLHIV and an estimated adult prevalence of 4.9% (NASCOP, 2019).

In Kenya, the HIV epidemic shows diversity by gender, age and geography. For example, females are disproportionately affected with a higher prevalence compared to men (7.5% versus 5.6%) among those aged 15-64 (NACC, 2014). Young women aged 15-24 years are particularly vulnerable with three times the HIV prevalence of young men in the same age group, 3% versus 1% respectively (NASCOP, 2014). HIV prevalence also varies widely by geographical region ranging from 0.4% in Wajir County to 26% in Homa Bay County (NACC, 2016) around start of the evaluation period. More recent data from KENPHIA survey in 2018 around the end of the evaluation period showed that the prevalence

ranged between less than 1% in Garissa to 19.6% in Homa Bay County and prevalence of HIV in women at 6.6% compared to 3.1% in men (NASCOP, 2019).

Kenya has made progress in the response to the HIV epidemic. In 2015, Kenya adopted the UNAIDS 90-90-90 global treatment targets to ensure 90 percent of people living with HIV are diagnosed, 90 percent of those diagnosed are on antiretroviral therapy (ART) and 90 percent of people on ART are virally suppressed by 2020 (UNAIDS, 2014). In the same year, emphasis on a data-driven approach led to the development and utilization of county HIV profiles to guide implementation (NACC, 2014). By the end of 2015, 900,000 PHLIV had been initiated on lifesaving ART with a treatment gap of 40%. To close this gap, Kenya adopted the World Health Organization's (WHO) test and start guidelines in 2016 (NASCOP, 2016).

These guidelines address HIV testing and linkage services including self-testing to facilitate achievement of the first 90 target. A defined standard package of care for PLHIV was adopted including universal access to ART for children, adolescents and adults to support the achievement of the second 90 target. Guidance also included innovative patient-centered models to support adherence and retention, such as differentiated care approaches at facility and community level to support the achievement of the third 90 target (NASCOP, 2016). However, not much is known about the implementation of these interventions in resource limited settings, particularly in Machakos, Makueni and Kitui counties of lower eastern region in Kenya where the CHS Naishi project was implemented. This evaluation seeks to document and assess the various public health interventions and strategies employed along the 90-90-90 cascade of identification, antiretroviral treatment and viral suppression, and other patient outcomes in the three counties supported by CHS-Naishi. Declining incidence of HIV may be reflected in decreasing positivity among populations tested for HIV while viral suppression rates may have a bearing on transmission rates and disease outcomes such as immune recovery. Progress towards HIV epidemic control was documented through assessment of HIV positivity rates, HIV treatment outcomes as well as institutionalization of structural interventions within the counties.

2. JUSTIFICATION FOR EVALUATION

The purpose of this evaluation was to utilize routinely collected health facility as well as administrative information to identify and document sustainable interventions for HIV epidemic control in CHS Naishi project-supported health facilities in Machakos, Makueni and Kitui counties. Understanding results from routine program data will provide useful information to evaluate the results from program implementation and inform project strategies. Evaluating routine program data will also inform county and country interventions aimed at epidemic control. In addition, it will contribute to the body of knowledge on sustainable interventions for epidemic control in resource-limited settings.

3. STAKEHOLDER ENGAGEMENT

The key stakeholders included County Health Management Teams (CHMT) in Machakos, Makueni and Kitui, National AIDS and STI Control Program (NASCOP), NTLD-Program, the MOH, the CDC, clients, the general public, healthcare workers, and community gate-keepers/key informants, CHS NAISHI, and other programs working in Lower Eastern to identify more HIV/TB cases, put them on treatment, and improve their treatment outcomes. MOH, through the various County MOH heads was sought to provide authorization to undertake the evaluation activities. The key stakeholders were involved in the evaluation process as much as possible by seeking input from them at every stage of the evaluation. There was also leveraged on the existing relationships between the stakeholders and the NAISHI Project during the evaluations. Some of the stakeholders were directly involved in the planning, execution, and dissemination plans of evaluation findings.

4. INTENDED/POTENTIAL USE OF EVALUATION FINDINGS

Evaluation findings will be used to review project performance towards achieving the goal of epidemic control. Findings will also be disseminated as presentations to local and international audiences; and abstracts as well as manuscripts will be developed for possible publication in peer reviewed journals. Evaluation findings will also be used to inform and contribute to policy development and review at county and country-level aimed at HIV epidemic control. The final evaluation report is in alignment with the PEPFAR Evaluation Standards of Practice requirements

and will be posted (in English) on a publicly accessible website within 90 days of report CDC clearance.

5. GOAL AND OBJECTIVES

The goal of this evaluation was to evaluate the implementation of sustainable interventions aimed at achieving epidemic control across NAISHI Project supported health facilities in lower eastern Kenya between October 2016 and March 2021.

Evaluation Objectives:

1. To evaluate public health interventions and models for quality HIV prevention and treatment towards epidemic control.

    1.1 To describe patient characteristics and outcomes for children, adolescents, young people, adults, men and the aging across program areas including HIV testing services (HTS), adult and pediatric support, care and treatment

    1.2 To evaluate the implementation of interventions aimed at achieving the 90-90-90 targets and outcomes of the interventions

METHODS

1. METHODOLOGY AND DESIGN

The design used in the evaluation was-cross-sectional. We only used quantitative data collection methods. Both prospective and retrospective routinely collected program data and patient cohort data were used for the evaluation. The patient data as available for the evaluation were restricted to those seen between 1st October 2016 and 30th March 2021. The evaluation type, design, data collection, data sources, as well as the indicators are elaborated in the evaluation matrix (Appendix 1A).

2. POPULATION

Clients accessing HIV treatment services from the 231 CHS-supported sites. In addition, the stakeholders in the community ART groups like; Treatment adherence clubs (TACs), Community health volunteers (CHVs), Civil society organizations (CSOs), Community-based organizations (CBOs), County & sub-county health management teams, and community gate-keepers/ Key informants were involved in the planning and execution of the evaluation activities by way of notice and meetings to provide input or concurrence before any activities were implemented. The MOH through respective county government ministries of health has provided authorization to undertake the evaluation activities. The MOH, county governments and the community who are some of our key stakeholders were involved in the evaluation process as much as possible by seeking input from them at every stage of the evaluations. We also heavily leveraged on the existing relationships between the stakeholders and the NAISHI project during the evaluations. These stakeholders were also involved in the planning, execution and dissemination of evaluation findings.

Eligibility

All clients accessing HIV services or PLHIV enrolled in the 231 Naishi project supported health facilities at the time of evaluation were eligible for inclusion.

3. SAMPLING METHODOLOGY

The evaluation used routine HIV care and treatment data, so no clients were recruited directly. All clients who have received services at CHS Naishi project supported facilities whose data is available in the electronic medical record systems and registers and meeting inclusion criteria were included and therefore sampling procedures to determine the sample size are not anticipated. We included data from 2,131,371 HIV tests and 64,756 new and continuing clients accessing HIV care and treatment services at the 231 CHS Naishi supported sites within the project period, and meeting the inclusion criteria.

4. DATA COLLECTION, DATA MANAGEMENT, AND ANALYSIS

Data Collection

Data was captured through the national MOH system as well as other supplementary systems. The primary source of data included: Comprehensive care clinic (CCC) patient card, Tuberculosis (TB) screening tools, Pre and ART registers, daily activity registers, HIV testing and counseling register and lab result slips, TB register, presumptive register. The above source documents which are Ministry of Health (MOH) tools used to collect patient information and are filled by service providers either real-time or after the patient has left. To supplement these tools, CHS developed other tools that have been accepted and implemented in the health facilities including the CCC appointment register, defaulter tracing register, pre-enrolment & referral registers, viral load register. Data aggregated from these tools are reported to the MOH through reporting tools such as MOH 711, MOH 731 and MOH 717 which are hybrid (exist in both paper and updated electronic copies). These reports are entered into a national web-based reporting system called District Health Information System (DHIS2).

To support this, CHS implemented a PostgreSQL web-based electronic medical record called C-PAD and fully transitioned to IQCare in 2018. The systems capture patient level data and makes it easier for service providers to access all information regarding a patient for decision-making. CHS works closely with data clerks and health records and information officers (HRIOs) at the facility level by doing routine and non-routine data collection and entry to ensure that the database is up to date and that the data meets set data quality standards including accuracy, validity, reliability, completeness and relevance. This data is then uploaded automatically and securely to the web-based EMRs. The data collected was only accessible via password protected user accounts. The aggregate database also stored data obtained through routine and systematic assessment of management units. These data were collected through assessment tools developed by both CHS and other partners and they include facility assessment tool, PMTCT assessment tool, site start-up assessment tool and CHMT assessment tool. CHS also supports other electronic medical records (EMR) systems like ART dispensing tool (ADT). These systems have patient-level data and were customized to provide various MOH reports. At the site-level, the EMR systems are used to assess patient outcomes, manage appointments and track performance in accordance with the national guidelines. Individual level data were extracted directly from the C-PAD, IQ-Care and other EMRs using structured query language (SQL) scripts. This was done by data managers who have passwords to access to the databases. All the patient identifiers were removed and coding of the data took place before analysis.

Data Management and Storage

The evaluation and data management team loaded all the data into a customized Microsoft Access database for cleaning and validation. All data were anonymized by the data manager to remove all identifiable information such as names, patient id, location etc. before exporting to Stata version 17 software. The clients' unique database identifiers (patient CCC number) were hashed into complex alphanumeric codes (and the identifier deleted) during any download or export from the databases to only assist in correct data merging and protect the confidentiality of the clients. All the completed paper questionnaires will be stored under lock & key in a cabinet situated at the CHS head office, for a period of five years after which they will be destroyed by shredding. All electronic routine patient data in the EMRs will be retained for continual use during patient follow-up care and treatment as they formed a useful part of clients' history. All the other non-routine data electronic files were destroyed by running permanent deletion software such as 'Active Eraser' on the computers, flash and hard drives to prevent data recovery of the same. All data will be stored in encrypted folders in a password-protected computer accessible to the study data management team only. Real time data backups of electronic patient records in both IQ-Care and CPAD electronic medical record systems were set up on the CHS data servers by the data manager and information technology manager. All other electronic data were regularly and securely backed up by the data manager on the CHS servers. The quality of the data from the Health Information Systems (HIS) were assessed for and reported. Data is owned jointly by Ministry of Health and CHS, with use and release determined by applicable Ministry of Health, CDC and CHS policies. The principal investigator is responsible for ensuring adherence to data integrity and prevent inadvertent access to study data. Data sources are provided in Appendix 1B.

Statistical Analysis

Baseline characteristics of clients and health facilities were determined. Descriptive statistics like mean (standard deviation), median (interquartile interval [iqi]) and counts (proportions) were used as appropriate. Temporal trends in HIV testing numbers and outcomes were assessed for. Statistical tests like Chi Square test of association, ranksum tests were used where appropriate for either categorical

or continuous data. Non parametric test of trend Jonckheere-Terpstra Test) on quarterly project totals on key HIV testing data outputs and outcomes since start of project to the first quarter in 2021. Logistic regression analyses were done to assess the factors associated with viral un-suppression (viral load >=1000 copies per ml) among clients on ART reporting the adjusted Odds Ratios [aOR] (95% confidence intervals (CI)). Competing risk regression analyses were done to assess the factors associated with time on ART to LTFU, (mortality or transfer out outcome were the two competing events for LTFU since they were no longer at risk of being LTFU). Similar competing risk regression analyses were done to assess the factors associated with time on ART to mortality, (LTFU or transfer out outcomes were the two competing events for mortality since they were no longer at risk of mortality at the censoring date). Kaplan-Meier calculation does not consider dependence between competing events of death, transfer out and LTFU which is rectified by competing risks regression analysis. The cumulative incidence function (CIF) plots and sub hazard ratios (SHR 95% confidence intervals (CI)) were presented for LTFU and mortality outcomes. Complete case analysis was used given the large number of observations and little to missing data on all the key variables used. All statistical tests were evaluated at the 5% level of significance. All regression analyses done at the project level, adjusted for clustering (at the facility level) and reported robust standard errors. Statistical analysis for quantitative data was done using Stata software version 17 (Stata Corp, College Station, TX) and Statistical Analysis System (SAS) Release 9.4 for windows (SAS Institute Inc. Cary, NC, USA).

Evaluation Limitations

The evaluation relied on routinely collected facility data which had some missingness, may have had incorrect values written. Some clients that were recorded as having incomplete or missing outcomes were most probably enrolled in or provided treatment at other facilities in or out of the region. We were unable to obtain sufficiently complete data on some variables such as weight and height; therefore, BMI was not included in the analyses among other variables not collected that may have introduced some bias. However, given the large numbers we believe the statistical inferences will be largely valid. We therefore relied solely on the available records from the EMR as available.

ETHICAL CONSIDERATIONS

All the data proposed to be used in this cohort reporting is routinely collected in the support and delivery of medical services. Each client was assigned a unique identifier in the access database and

confidentiality was ensured by stripping patient medical information of names and other personal identifiers by the data manager during analysis dataset preparation. All data used were coded using unique database identifiers to safeguard patient details. Results were reported in aggregate without referencing patient details. Analysis of this medical data will provide information that is beneficial in guiding patient management and improving outcomes among HIV positive clients.

The evaluation protocol was reviewed in accordance with the U.S. Centers for Disease Control and Prevention (CDC) human research protection procedures and determined to be research, but CDC investigators did not interact with human subjects or have access to identifiable data or specimens for research purposes. Local approval for the evaluation was obtained from AMREF ethics and scientific review committee (P412-2017).

FINDINGS

1. HTS TRENDS

The total number of HIV tests done in outpatient department (OPD) between October 2016 and March 2021 in the 3 counties was 1,737,612 tests. Makueni County had the highest number of tests done 592,240. The significant non-linear trend (P value <0.001) showed a marked increase in the project total number of tests from quarter 4 of 2017 and peaking in quarter 2 of 2018 after which there was some decline as shown in the Table 1 and Figure 1.

Table 1: HTS samples tested in OPD, October 2016 - March 2021

County	Kitui County	Machakos County	Makueni County	Project Totals	*Trend test, P value
2016q4	32332	41408	35846	109586	<0.001
2017q1	39597	45696	39156	124449	
2017q2	35778	39722	32231	107731	
2017q3	22367	23637	25964	71968	
2017q4	34539	30379	32041	96959	
2018q1	70195	42561	50602	163358	
2018q2	56025	41354	75655	173034	
2018q3	36365	33453	52888	122706	
2018q4	28461	32561	31093	92115	
2019q1	33333	35823	35318	104474	
2019q2	35114	40923	41137	117174	
2019q3	31257	43067	42945	117269	
2019q4	32209	28958	27249	88416	
2020q1	23685	28520	23092	75297	
2020q2	12360	18119	12671	43150	
2020q3	11859	21038	12870	45767	
2020q4	11610	16870	10329	38809	
2021q1	14727	19470	11153	45350	
Cumulative Total	561813	583559	592240	1737612	

* Non parametric test of trend on project totals (Jonckheere-Terpstra Test)

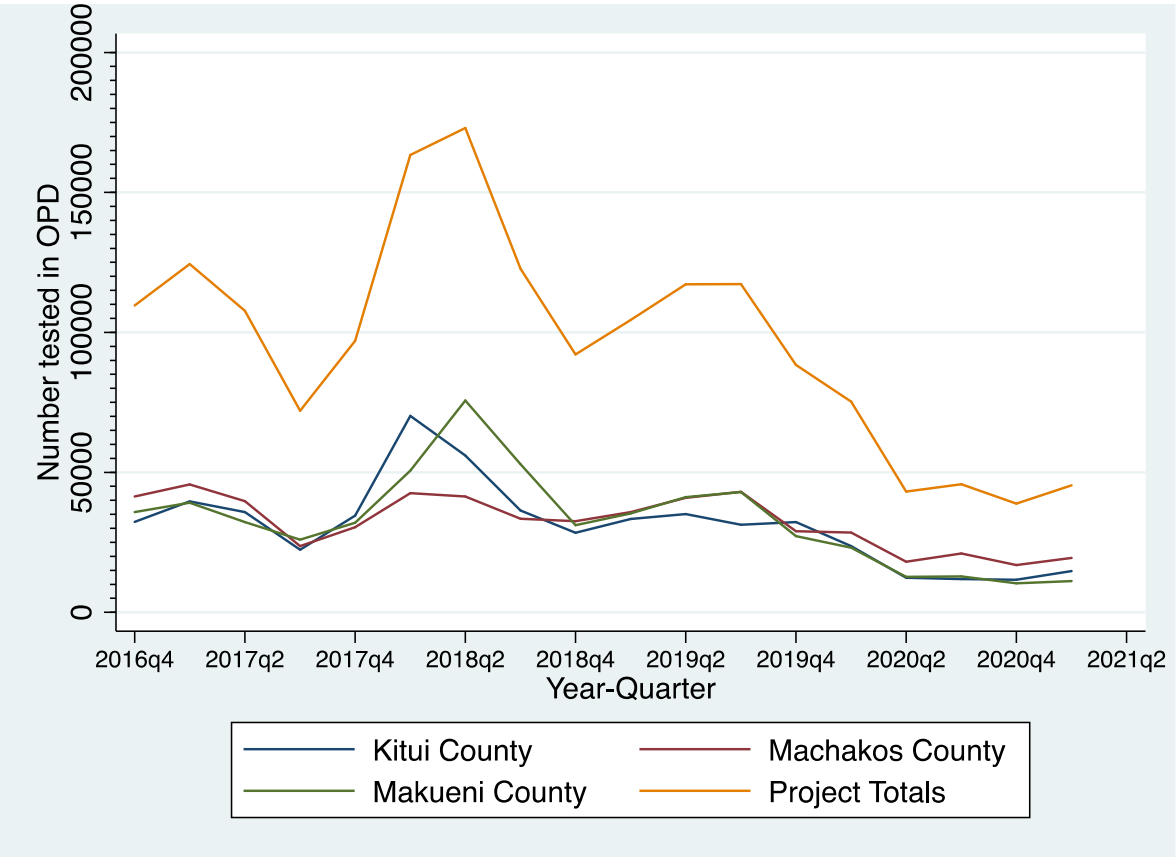

Figure 1: HTS samples tested in OPD, October 2016 - March 2021

The total number of HIV positive results in OPD in the 3 counties was 22,082 from tests done. Machakos County had the highest number of HIV positive test results from all the tests done (n= 9,758), and it had consistently higher numbers of HIV positive results in the OPD throughout the quarters. There is also a significant non-linear trend (P value <0.001) indicating a marked increase in the project total number of HIV positive tests from quarter 4 of 2017 and peaking in quarter 2 of 2018. However, the results show a decline thereafter (see Table 2 and Figure 2).

Table 2: HIV positive results in OPD, October 2016 - March 2021

County	Kitui County	Machakos County	Makueni County	Total	*Trend test, P value
2016q4	365	697	428	1490	<0.001
2017q1	513	663	484	1660	
2017q2	472	607	394	1473	
2017q3	345	495	372	1212	
2017q4	319	487	431	1237	

2018q1	573	620	469	1662
2018q2	456	734	570	1760
2018q3	339	664	398	1401
2018q4	290	550	279	1119
2019q1	348	568	321	1237
2019q2	323	578	287	1188
2019q3	285	657	378	1320
2019q4	317	462	278	1057
2020q1	316	514	283	1113
2020q2	204	350	177	731
2020q3	236	358	192	786
2020q4	218	290	179	687
2021q1	304	464	181	949
Cumulative Total	6223	9758	6101	22082

* Non parametric test of trend on project totals (Jonckheere-Terpstra Test)

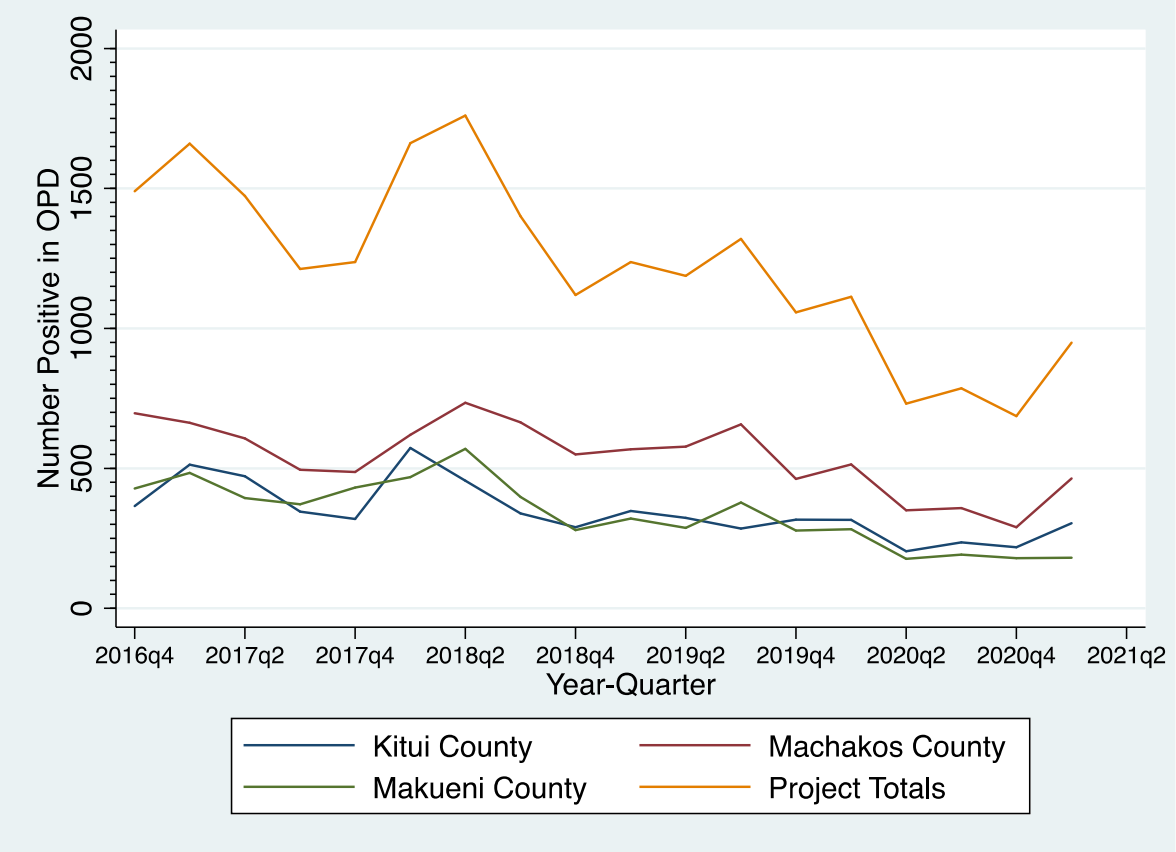

Figure 2: HIV Positive in OPD, October 2016 - March 2021

HIV positive clients who were linked in OPD

The total number of clients linked in OPD among those clients with positive HIV results in the 3 counties was 21,037. Machakos County had the highest number of HIV positive clients linked in OPD throughout the quarters (n=9318). Similarly, a significant non-linear trend (P value <0.001) indicated a marked increase in the number of tests from quarter 2 of 2017 and peaking in quarter 2 of 2018 with some decline in the numbers as shown in the Table 3 and Figure 3.

Table 3: HIV positive clients who were linked in OPD, October 2016 to March 2021

County	Kitui County	Machakos County	Makueni County	Total	*Trend test, P value
2016q4	327	647	375	1349	<0.001
2017q1	455	587	444	1486	
2017q2	424	538	345	1307	
2017q3	313	444	324	1081	
2017q4	312	473	408	1193	
2018q1	555	601	438	1594	
2018q2	445	709	545	1699	
2018q3	321	649	385	1355	
2018q4	281	543	272	1096	
2019q1	343	555	315	1213	
2019q2	316	564	281	1161	
2019q3	279	639	369	1287	
2019q4	309	453	271	1033	
2020q1	311	497	281	1089	
2020q2	204	339	177	720	
2020q3	232	352	192	776	
2020q4	212	285	179	676	
2021q1	300	443	179	922	
Cumulative Total	5939	9318	5780	21037	

* Non parametric test of trend on project totals (Jonckheere-Terpstra Test)

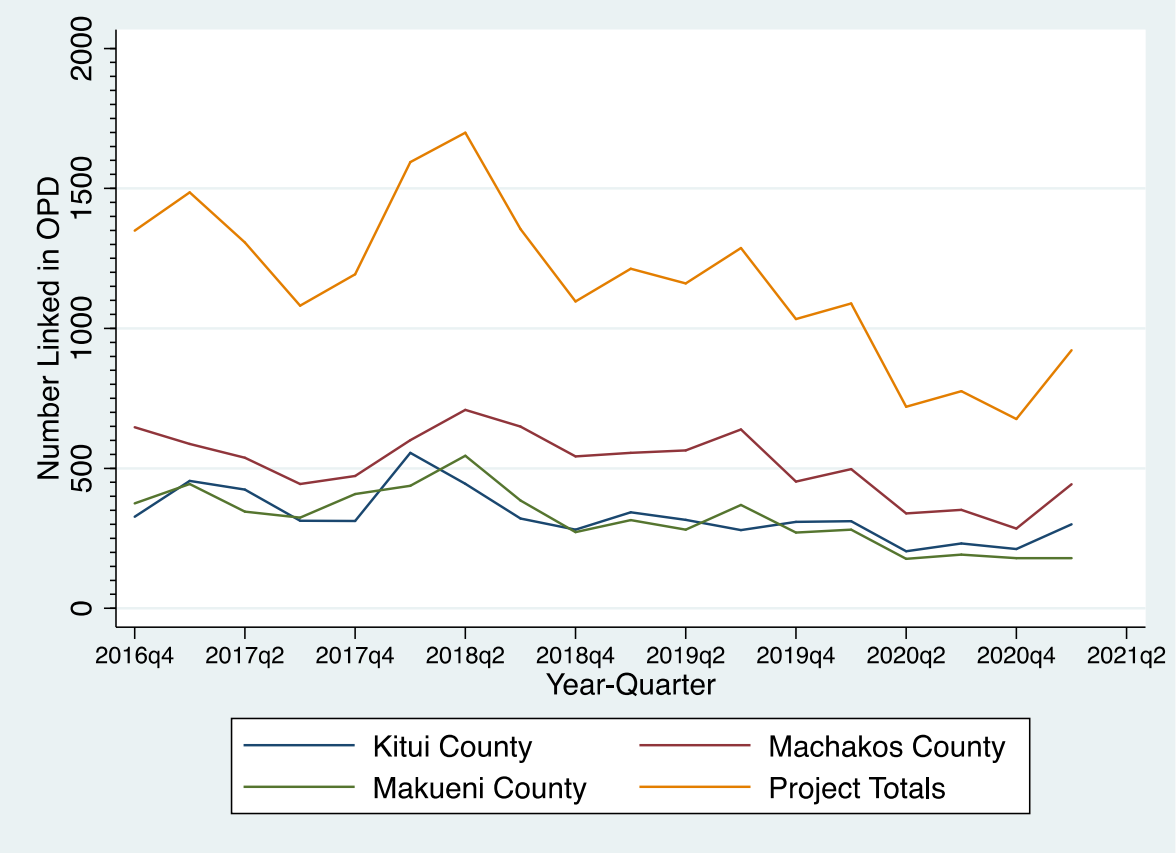

Table 3: Positives Linked in OPD, October 2016 to March 2021

HTS Tested for HIV in IPD

The total number of HIV tests done in the in-patient department (IPD) in the 3 counties was 92,810 tests. Overall, Kitui County had the highest number of tests done (n= 34,245), with results showing an increase in the number of tests between quarter 2 of 2017 and quarter 1 of 2018. A significant non-linear trend (P value = 0.001) indicated a marked increase in the project total number of tests in IPD from quarter 4 of 2017 and peaking in quarter 1 of 2018 after which there was some decline as shown in Table 4 and Figure 4.

Table 4: Clients who did HIV tests in IPD, October 2016 to March 2021

County	Kitui County	Machakos County	Makueni County	Project Totals	*Trend test, P value
2016q4	2624	3084	1623	7331	0.001
2017q1	1097	1230	1351	3678	

2017q2	2227	2540	1841	6608
2017q3	1	769	606	1376
2017q4	1341	1135	1782	4258
2018q1	6363	3023	2828	12214
2018q2	2160	1315	2758	6233
2018q3	2475	1731	1611	5817
2018q4	3319	1613	1570	6502
2019q1	3557	2051	1977	7585
2019q2	3155	1949	2619	7723
2019q3	1701	1930	2203	5834
2019q4	1489	1898	1752	5139
2020q1	985	2003	1323	4311
2020q2	417	1080	820	2317
2020q3	326	702	916	1944
2020q4	479	968	471	1918
2021q1	529	935	558	2022
Cumulative Total	34245	29956	28609	92810

* Non parametric test of trend on project totals (Jonckheere-Terpstra Test)

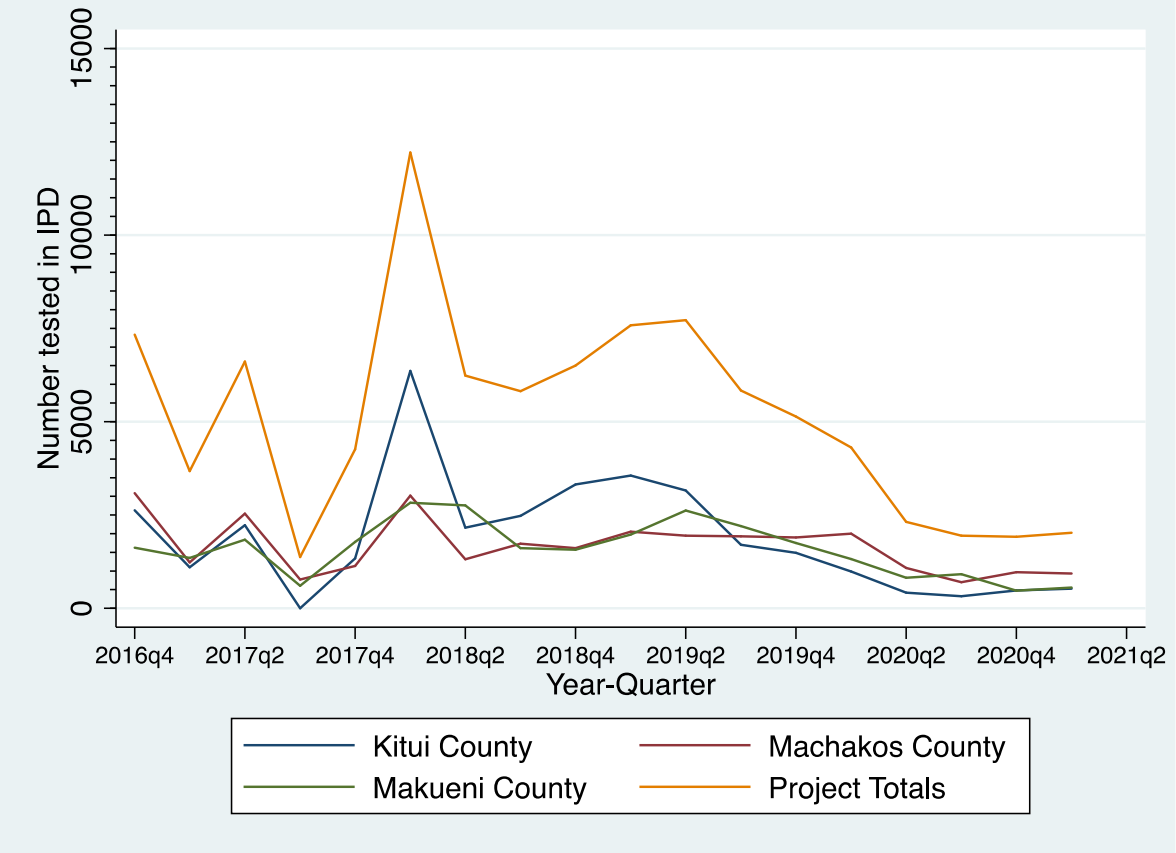

Figure 4: Clients who did HIV tests in IPD, October 2016 to March 2021

HIV positive clients in IPD

The project total number of clients with HIV positive results in IPD in the 3 counties was 875 from tests done. Machakos County had the highest number of clients with HIV positive test results from all the tests done in IPD, n=372. There was a significant non-linear trend (P value = 0.033) indicated a marked increase in the project total number of HIV positive tests in IPD in quarter 2 2017 and also from quarter 4 of 2017 and peaking in quarter 2 of 2019 as shown in Table 5 and Figure 5.

Table 5: Positive in IPD, October 2016 to March 2021

County	Kitui County	Machakos County	Makueni County	Total	*Trend test, P value
2016q4	19	22	24	65	0.033
2017q1	6	35	11	52	
2017q2	19	38	25	82	
2017q3	0	21	8	29	

2017q4	14	15	13	42
2018q1	7	30	18	55
2018q2	20	12	12	44
2018q3	26	14	9	49
2018q4	27	17	7	51
2019q1	23	22	11	56
2019q2	34	17	19	70
2019q3	9	13	11	33
2019q4	18	34	11	63
2020q1	15	27	18	60
2020q2	7	13	5	25
2020q3	7	13	18	38
2020q4	9	18	7	34
2021q1	3	11	13	27
Cumulative Total	263	372	240	875

* Non parametric test of trend on project totals (Jonckheere-Terpstra Test)

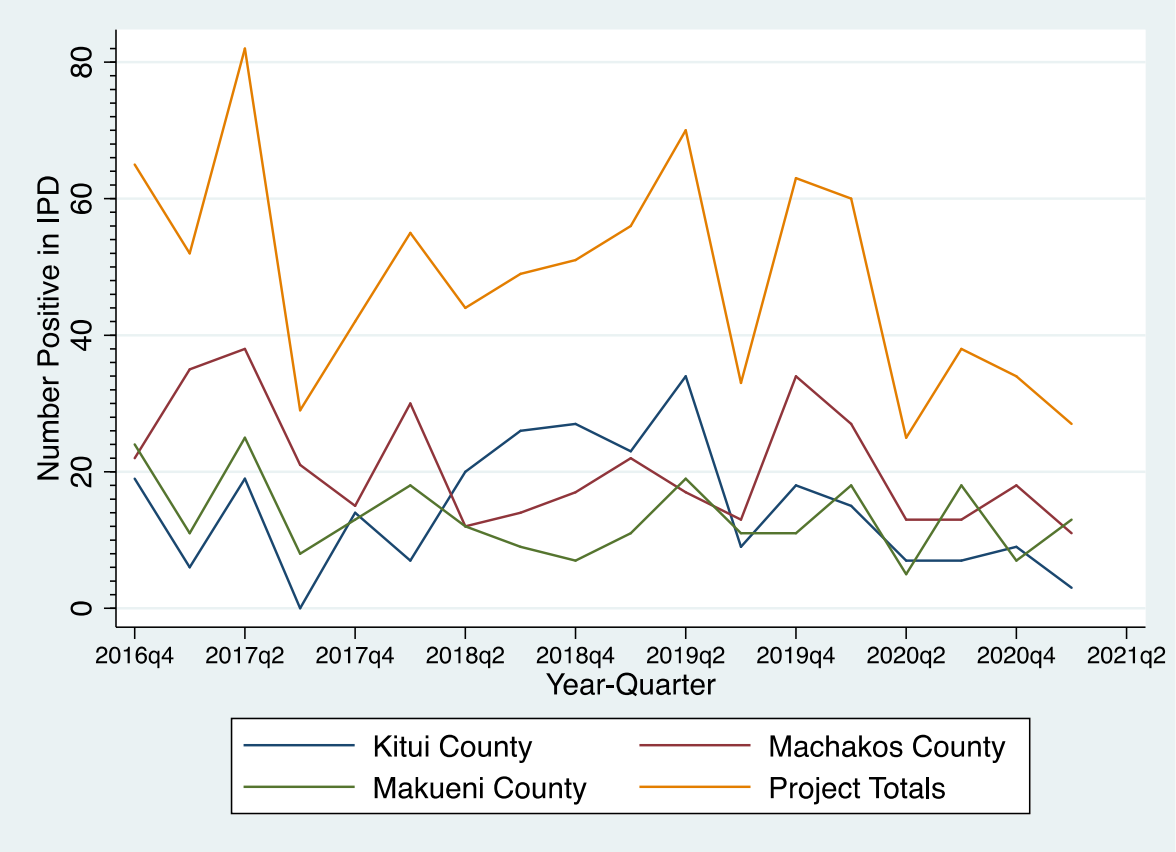

Figure 5: Positive in IPD, October 2016 to March 2021

Positives Linked in IPD

The total number of clients linked in IPD among those with positive HIV results in the 3 counties was n=552. Machakos County had the highest number of HIV positive clients linked in IPD, n=231. Similarly, a significant non-linear trend (P value= 0.049) indicated a marked increase in the number of clients linked from quarter 3 of 2017 and peaking in quarter 1 of 2020 and with a decline in the numbers thereafter as shown in the Table 6 and Figure 6.

Table 6: Positives Linked in IPD, October 2016 to March 2021

County	Kitui County	Machakos County	Makueni County	Total	*Trend test, P value
2016q4	7	9	11	27	0.049
2017q1	0	12	2	14	
2017q2	0	6	6	12	
2017q3	0	5	2	7	
2017q4	10	8	10	28	
2018q1	7	28	8	43	
2018q2	10	11	8	29	
2018q3	17	8	4	29	
2018q4	16	8	5	29	
2019q1	17	19	9	45	
2019q2	26	14	14	54	
2019q3	8	12	11	31	
2019q4	14	23	9	46	
2020q1	14	24	16	54	
2020q2	6	10	3	19	
2020q3	7	11	17	35	
2020q4	7	16	5	28	
2021q1	3	7	12	22	
Cumulative Total	169	231	152	552	

* Non parametric test of trend on project totals (Jonckheere-Terpstra Test)

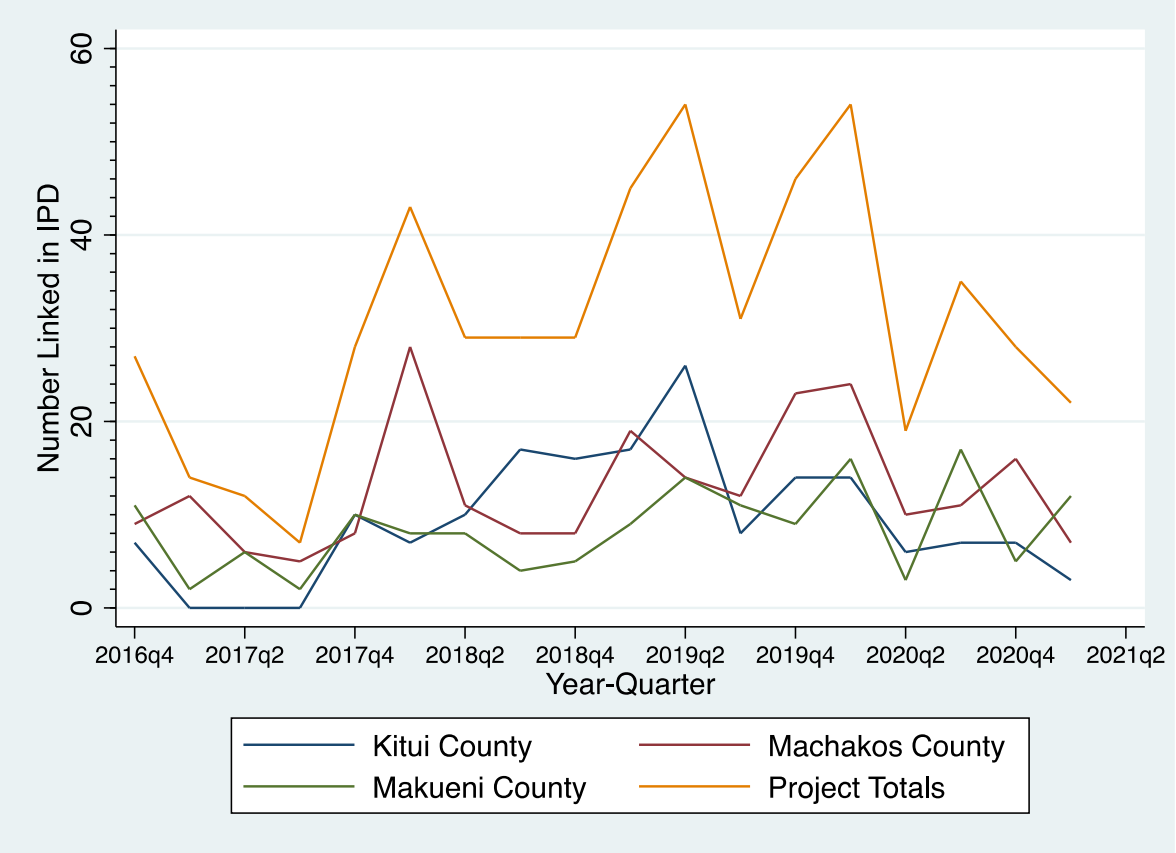

Figure 6 Positives Linked in IPD, October 2016 to March 2021

HTS tests conducted , October 2016 to March 2021

The total number of HIV tests done in all departments which include OPD, IPD, emergency/casualty, and voluntary counselling and testing clinic, assisted partner notification services, sexually transmitted infection clinic, mother and child clinic, nutrition clinic, and TB clinic in the 3 counties was 2,131,371 tests. Overall, Machakos County had the highest number of tests done, n= 744,498, with results showing an increase in the number of tests in quarter 4 of 2017 and quarter 1 of 2018. A significant non-linear trend (P value = 0.001) indicated a marked increase in the overall project total number of tests in quarter 4 of 2017 and quarter 1 of 2018 after which there was some decline as shown in the Table 7 and Figure 7. The peak in HIV testing can be attributed to the increased investments in Program year two where additional counsellors were recruited and additional HIV testing booths supported in some select facilities. Thereafter, there was introduction of more efficient HIV testing strategies like eligibility screening and the index case testing modalities

and reduction in the number of HIV testing counsellors and available HIV testing kits thus reducing the number of clients tested in the subsequent project years. A further reduction in HIV testing numbers in quarter 2 of 2020 coincided with the first peak of Covid 19 epidemic in Kenya.

Table 7 Clients who had HTS tests in all departments, , October 2016 to March 2021

County	Kitui County	Machakos County	Makueni County	Project Totals	*Trend test, P value
2016q4	38278	48792	40038	127108	0.001
2017q1	43329	53096	45416	141841	
2017q2	39873	48846	38077	126796	
2017q3	23028	26230	28708	77966	
2017q4	40855	40438	38629	119922	
2018q1	83965	58976	57597	200538	
2018q2	64357	56104	82899	203360	
2018q3	45133	45717	58793	149643	
2018q4	39206	43672	36535	119413	
2019q1	47360	49963	46048	143371	
2019q2	46516	52026	46283	144825	
2019q3	38158	49877	47045	135080	
2019q4	38941	34769	30785	104495	
2020q1	30605	36649	27504	94758	
2020q2	18390	23990	17316	59696	
2020q3	17207	26202	17248	60657	
2020q4	18662	21969	13022	53653	
2021q1	23747	27182	17320	68249	
Cumulative Total	697610	744498	689263	2131371	

* Non parametric test of trend on project totals (Jonckheere-Terpstra Test)

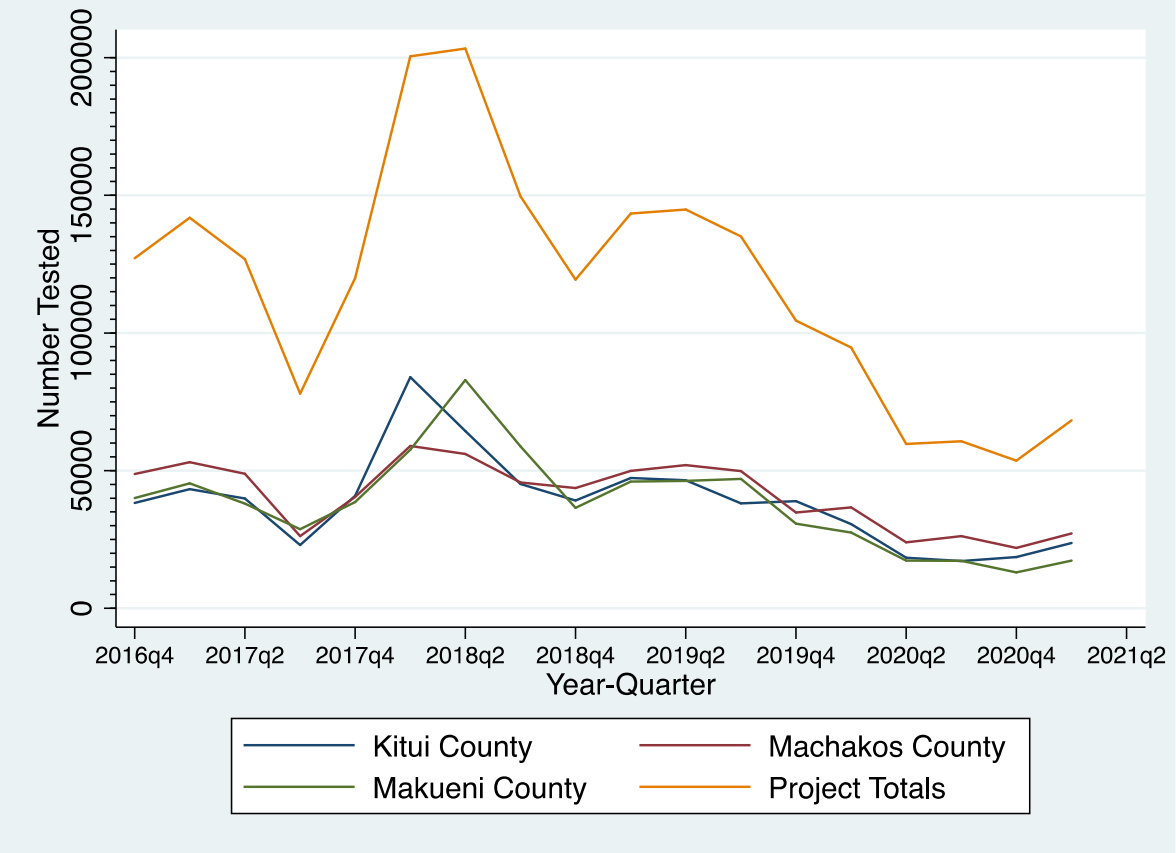

Figure 7 Clients who had HTS tests in all departments, , October 2016 to March 2021

Number of HIV positive clients in all departments

The total number of HIV positive results in OPD in the 3 counties was 33,636 from HIV tests done between October 2016 and March 2021. Machakos County had the highest number of HIV positive test results from all the tests done (n= 14,596). Machakos County had consistently higher numbers of HIV positive results throughout the quarters. There was an increase in project total number of HIV positive tests from quarter 4 of 2017 and peaking in quarter 2 of 2018, with a decline and some increases thereafter as shown in Table 8. However, the HIV positive percentage yield showed a significant trend in increase over the project period (p value <0.001) as shown in Figure 8. The peak in HIV identification in program year 2 was attributable to the increased investments in HIV testing where additional HTS counsellors were recruited and strategically deployed to support the identification surge. Thereafter, there was reduction in funding and subsequent reduction of the HIV testing counsellors and the HIV testing kits. Introduction of more efficient HIV identification

strategies like eligibility screening and index testing reduced the number needed to test to identify a HIV positive case by improving HIV testing yield from 1.3% in 2016 quarter 4 to 2.8% in 2021 quarter 1.

Table 8: HIV Positive clients in all departments, October 2016 to March 2021

County	Kitui County	Machakos County	Makueni County	Total	*Trend test, P value
	n (% yield)	**n (% yield)**	**n (% yield)**	**n (% yield)**	
2016q4	424 (1.1%)	741 (1.5%)	479 (1.2%)	1644 (1.3%)	<0.001
2017q1	528 (1.2%)	753 (1.4%)	528 (1.2%)	1809 (1.3%)	
2017q2	519 (1.3%)	699 (1.4%)	450 (1.2%)	1668 (1.3%)	
2017q3	357 (1.6%)	582 (2.2%)	403 (1.4%)	1342 (1.7%)	
2017q4	473 (1.2%)	797 (2.0%)	578 (1.5%)	1848 (1.5%)	
2018q1	758 (0.9%)	1005 (1.7%)	630 (1.1%)	2393 (1.2%)	
2018q2	620 (1.0%)	1123 (2.0%)	760 (0.9%)	2503 (1.2%)	
2018q3	464 (1.0%)	911 (2.0%)	511 (0.9%)	1886 (1.3%)	
2018q4	392 (1.0%)	764 (1.7%)	344 (0.9%)	1500 (1.3%)	
2019q1	625 (1.3%)	904 (1.8%)	496 (1.1%)	2025 (1.4%)	
2019q2	725 (1.6%)	957 (1.8%)	550 (1.2%)	2232 (1.5%)	
2019q3	574 (1.5%)	973 (2.0%)	682 (1.4%)	2229 (1.7%)	
2019q4	598 (1.5%)	790 (2.3%)	552 (1.8%)	1940 (1.9%)	
2020q1	678 (2.2%)	949 (2.6%)	610 (2.2%)	2237 (2.4%)	
2020q2	451 (2.5%)	661 (2.8%)	467 (2.7%)	1579 (2.6%)	
2020q3	446 (2.6%)	632 (2.4%)	449 (2.6%)	1527 (2.5%)	
2020q4	450 (2.4%)	544 (2.5%)	390 (3.0%)	1384 (2.6%)	
2021q1	593 (2.5%)	811 (3.0%)	486 (2.8%)	1890 (2.8%)	
Cumulative Total	9675	14596	9365	33636	
% of those Tested	1.40	2.00	1.40	1.60	

* Non parametric test of trend on project % yield (Jonckheere-Terpstra Test)

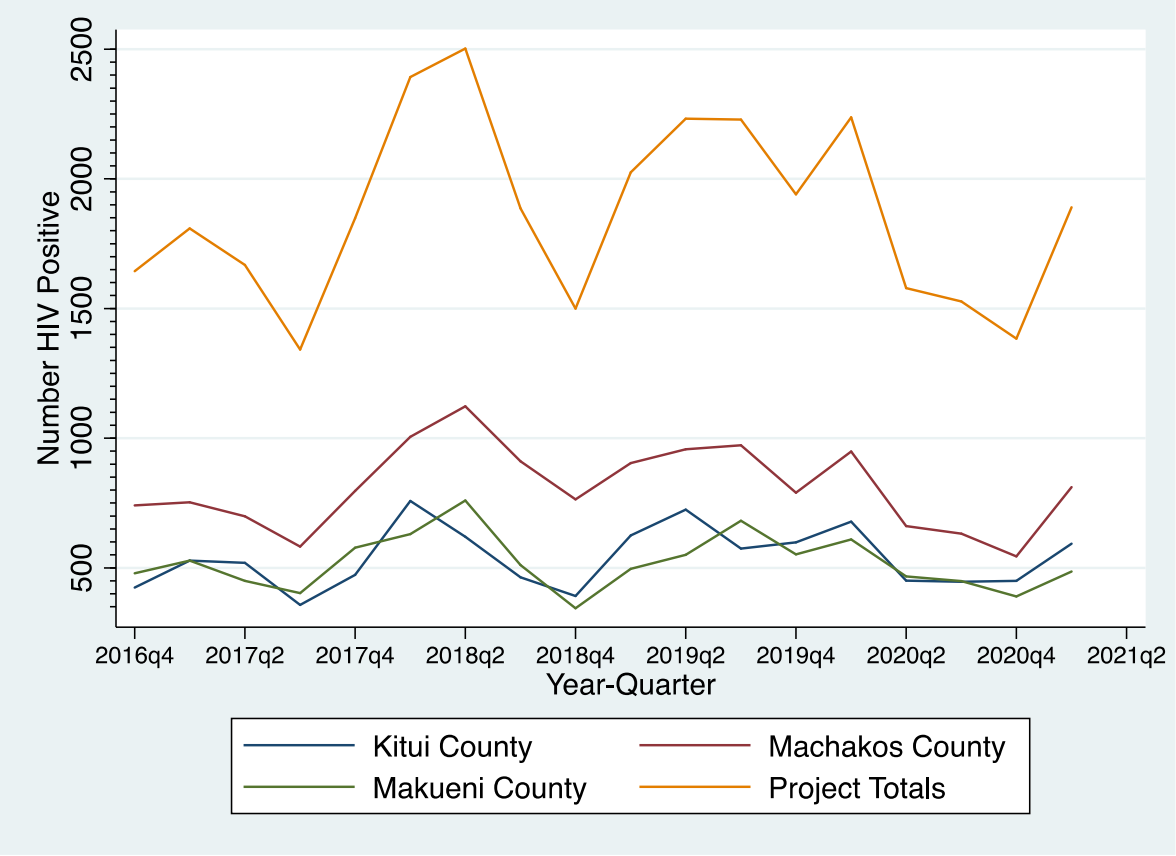

Figure 8: HIV Positive clients in all departments, October 2016 to March 2021

Number of HIV positive clients linked to care in all departments, October 2016 to March 2021

The total number of clients linked to care in all departments among those with positive HIV results in the 3 counties was 31,096, accounting for 92.4% of those clients who were identified as HIV positive. Machakos County had the highest number of HIV positive clients linked (n=13,501). Results indicated a marked increase in the number of clients linked from quarter 1 of 2018 and peaking in quarter 2 of 2018 coinciding with the HTS surge in project year 2 (Refer to Table 9 and Figure 9 below).

Table 9: Number of HIV positive clients linked to care in all departments, October 2016 to March 2021

County	Kitui County	Machakos County	Makueni County	Total	*Trend test, P value

2016q4	350	665	398	1413	0.390
2017q1	458	604	454	1516	
2017q2	424	568	354	1346	
2017q3	319	468	337	1124	
2017q4	433	708	522	1663	
2018q1	724	961	584	2269	
2018q2	587	1086	728	2401	
2018q3	427	884	489	1800	
2018q4	361	728	332	1421	
2019q1	584	856	487	1927	
2019q2	682	897	532	2111	
2019q3	540	918	628	2086	
2019q4	559	753	520	1832	
2020q1	644	893	583	2120	
2020q2	422	634	447	1503	
2020q3	425	608	437	1470	
2020q4	422	522	372	1316	
2021q1	561	748	469	1778	
Cumulative Total	8922	13501	8673	31096	
% of HIV positive	92.5	92.5	92.6	92.4	

* Non parametric test of trend on project totals (Jonckheere-Terpstra Test)

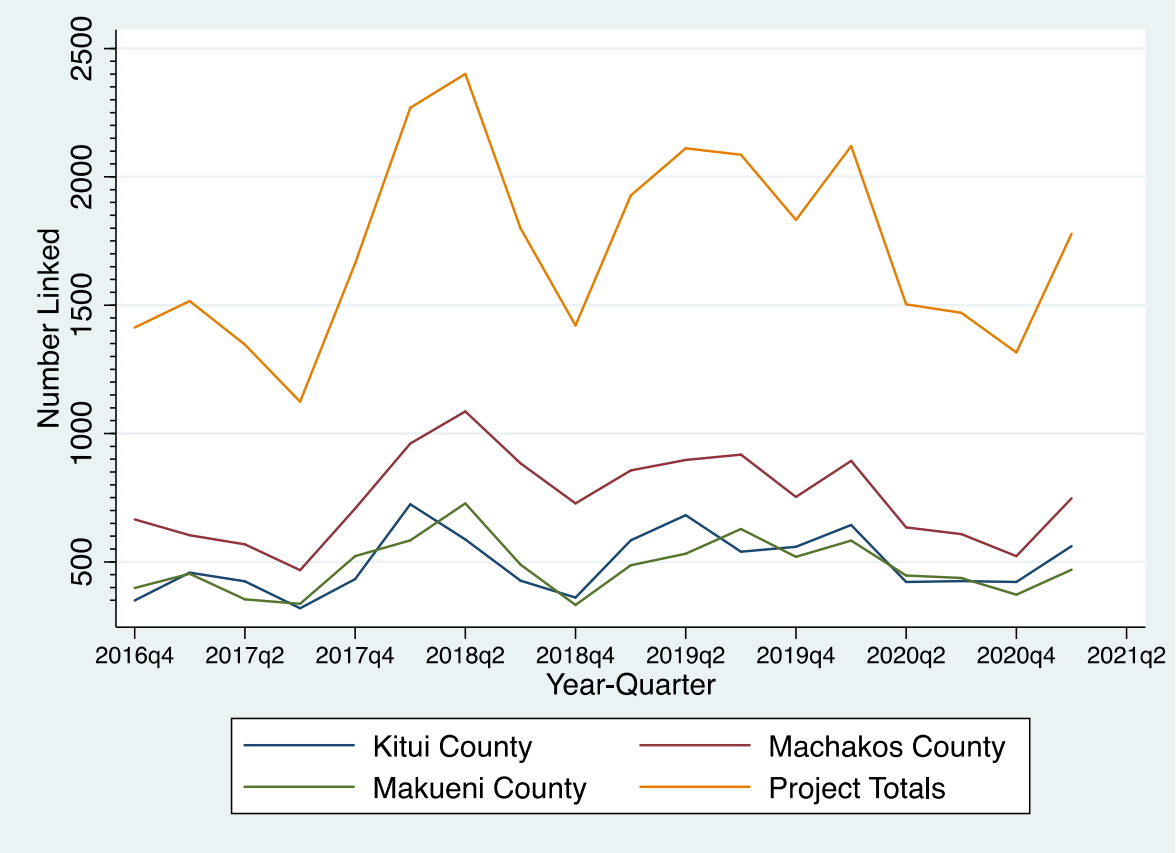

Figure 9: Number of HIV positive clients linked to care in all departments, October 2016 to March 2021

Number newly initiated on ART, October 2016 to March 2021

The total number of HIV positive clients linked to care and newly initiated on ART in the 3 counties was 29,696, accounting for 95.5% of those HIV positive and linked to care. Machakos County had the highest number of HIV positive clients newly initiated on ART (n= 12,557). Machakos County had consistently higher numbers of HIV positive clients linked throughout the quarters. Machakos County also had a slightly lower linkage to treatment rate at 93% compared to Kitui and Makueni Counties which linked 97.7% and 97.1% respectively. There was an increase and decrease in the numbers across the quarters as shown in Table 10 and Figure 10.

Table 10: Number of HIV positive clients who were newly initiated on ART, October 2016 to March 2021

County	Kitui County	Machakos County	Makueni County	Total	*Trend test, P value
2016q4	393	667	448	1508	0.676
2017q1	509	746	505	1760	
2017q2	495	690	416	1601	
2017q3	330	547	376	1253	
2017q4	426	622	393	1441	
2018q1	589	818	517	1924	
2018q2	567	878	651	2096	
2018q3	518	683	497	1698	
2018q4	404	666	363	1433	
2019q1	534	780	448	1762	
2019q2	622	845	515	1982	
2019q3	500	863	646	2009	
2019q4	498	662	466	1626	
2020q1	600	830	547	1977	
2020q2	395	574	425	1394	
2020q3	413	544	404	1361	
2020q4	383	467	369	1219	
2021q1	538	675	439	1652	
Cumulative Total	8714	12557	8425	29696	
% of HIV Positive and Linked	97.7	93	97.1	95.5	

* Non parametric test of trend on project totals (Jonckheere-Terpstra Test)

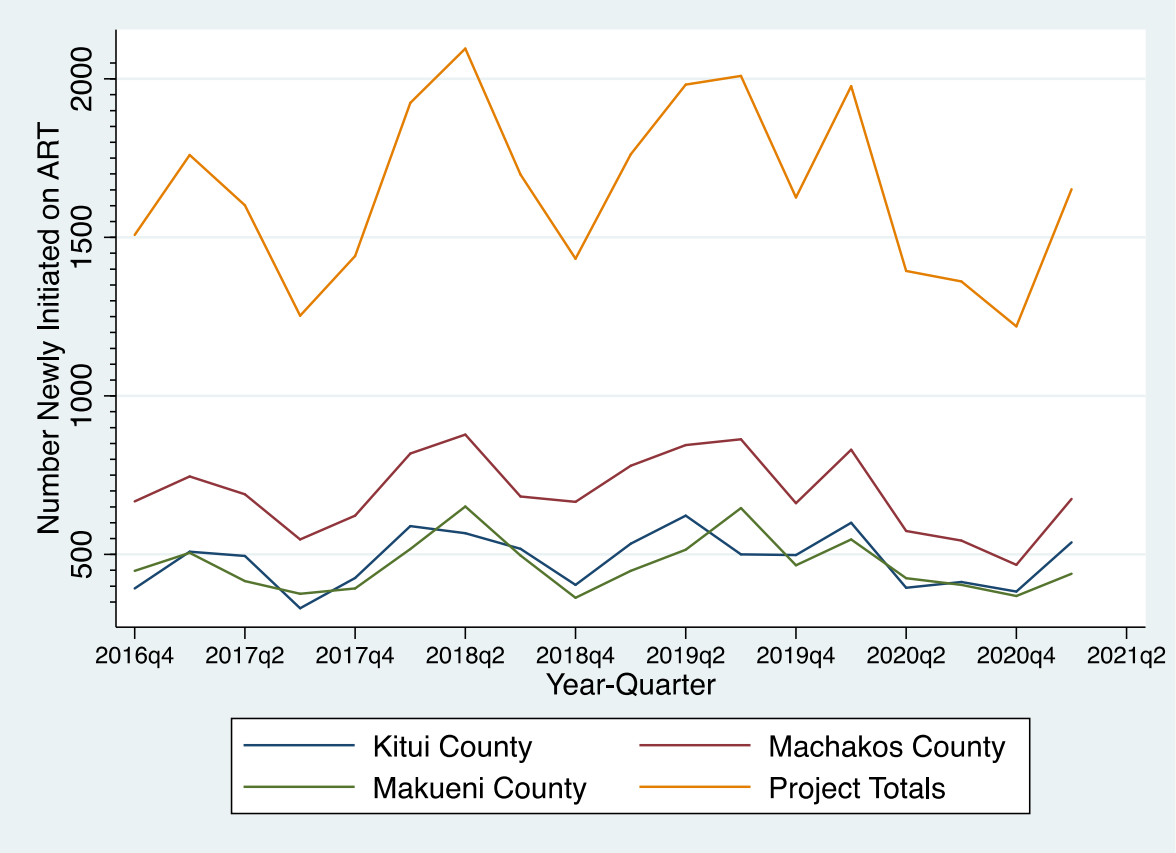

Figure 10: Number of HIV positive clients who were newly initiated on ART, October 2016 to March 2021

2. ANTIRETROVIRAL THERAPY OUTCOMES

Characteristics of HIV Positive Clients on ART

A total of 65,159 clients on ART were included in the analysis and most [44,853 (68.8%)], were females. The median age was 43.0 years (iqi: 32.9 - 52.0) and majority, 61,516 (94.4%), were adults. Less than half, 28,559 (43.8%), were married. More than half, 33,773 (51.8%), had a HIV WHO stage 1 classification at baseline. Over half, 39,202 (60.3%), were on TDF baseline core regimen and 55,515 (85.3%) on TDF as a current core regimen. Most, 46,194 (70.9%) and 49,779 (76.4%) were virally suppressed at baseline and current VS respectively. Very few, 301 (0.5%), had a documented comorbidity or chronic illness (such as cardiovascular disease, diabetes, chronic kidney disease, osteoporosis, hepatic disease, and cancer among others).

Table 11: Characteristics of HIV positive clients on ART, October 2016 to March 2021

Patient Characteristics n (%)	Total N= 65159
Age (Years) , median (iqi)	42.96 (32.88; 51.96)
Sex, n (%)	
Female, n (%)	44853 (68.8)
Male , n (%)	20306 (31.2)
Adult Category, n (%)	
Child, n (%)	3643 (5.6)
Adult, n (%)	61516 (94.4)
Age Categories (Years) , n (%)	
0-9yrs, n (%)	1618 (2.5)
10-14, n (%)	2025 (3.1)
15-19, n (%)	2534 (3.9)
20-24, n (%)	3007 (4.6)
25-34, n (%)	10891 (16.7)
35-44, n (%)	17142 (26.3)
45-54, n (%)	15831 (24.3)
55-64, n (%)	8710 (13.4)
65+, n (%)	3401 (5.2)
Marital Status, n (%)	

Married, n (%)	28559 (43.8)
Never married, n (%)	14158 (21.7)
Polygamous, n (%)	2909 (4.5)
Separated/Divorced, n (%)	5373 (8.2)
Unknown, n (%)	7860 (12.1)
Widowed, n (%)	6300 (9.7)
Baseline WHO stage, n (%)	
Unstaged, n (%)	20335 (31.2)
WHO Stage1, n (%)	33773 (51.8)
WHO Stage2, n (%)	7356 (11.3)
WHO Stage3, n (%)	3341 (5.1)
WHO Stage4, n (%)	354 (0.5)
BMI category, n (%)	
Underweight, n (%)	8816 (13.5)
Normal weight, n (%)	21675 (33.3)
Overweight, n (%)	8294 (12.7)
Obese, n (%)	4304 (6.6)
Not Indicated, n (%)	22070 (33.9)
Population type, n (%)	
General Population, n (%)	41598 (63.8)
Key Population, n (%)	461 (0.7)
Unknown, n (%)	23100 (35.5)
TB Status, n (%)	
No TB Signs, n (%)	41656 (63.9)
Presumed TB, n (%)	106 (0.2)
TB Confirmed, n (%)	18 (0.0)
Unknown, n (%)	23379 (35.9)
Baseline Core Regimen, n (%)	
ABC Based, n (%)	8988 (13.8)
AZT Based, n (%)	4056 (6.2)
D4T Based, n (%)	5287 (8.1)
TDF Based, n (%)	39202 (60.3)
Other, n (%)	7447 (11.5)
Current Core Regimen, n (%)	
ABC Based, n (%)	4258 (6.5)
AZT Based, n (%)	3523 (5.4)
TDF Based, n (%)	55515 (85.3)
Other, n (%)	1815 (2.8)
Baseline Viral suppression [<1000 copies/ml], n (%)	
<1000 copies/ml, n (%)	46194 (70.9)

>=1000 copies/ml, n (%)	5257 (8.1)
No VL done, n (%)	13708 (21.0)
Current Viral suppression, n (%)	
<1000 copies/ml, n (%)	49779 (76.4)
>=1000 copies/ml, n (%)	3265 (5.0)
No VL done, n (%)	12115 (18.6)
Has Comorbidity/Chronic illness, n (%)	
No, n (%)	41778 (64.1)
Unknown, n (%)	23080 (35.4)
Yes, n (%)	301 (0.5)
Time on ART, n (%)	
0-6 months, n (%)	5529 (8.5)
7-12 months, n (%)	1303 (2.0)
>12 months, n (%)	58327 (89.5)
Last ART Status, n (%)	
Active, n (%)	47274 (72.6)
Dead, n (%)	1948 (3.0)
Lost to follow-up, n (%)	10895 (16.7)
Transferred out, n (%)	5042 (7.7)

Treatment outcomes among HIV positive clients on ART

Overall, 47,274 (72.6%) were active on care, 5,042 (7.7%) transferred-out of care to other facilities, 10,895 (16.7%) were LTFU and 1,948 (3.0%) had died. On bivariate analysis, comparing the characteristics between those who are active, died, LTFU and transferred out, there were significant differences with respect to age, sex, marital status, HIV WHO stage, population type, TB status, core regimens, viral suppression, comorbidity or chronic illness status, and time period on ART as shown in Table 12.

Table 12: Treatment Outcomes among HIV positive clients on ART, October 2016 to March 2021

Columns by: Last ART Status	**Active**	**Dead**	**Lost to follow up**	**Transferred out**	**P-value**
n (%)	**47274 (72.6)**	**1948 (3.0)**	**10895 (16.7)**	**5042 (7.7)**	
n (%)					
Age (Years) , median (iqi)	43.96 (33.97; 52.96)	45.96 (36.95; 56.93)	38.53 (29.96; 48.43)	36.29 (27.33; 45.66)	<0.001

Sex, n (%)					
F, n (%)	32915 (69.6)	1141 (58.6)	7222 (66.3)	3575 (70.9)	
M, n (%)	14359 (30.4)	807 (41.4)	3673 (33.7)	1467 (29.1)	<0.001
Adult Category, n (%)					
Child, n (%)	2634 (5.6)	59 (3.0)	568 (5.2)	382 (7.6)	
Adult, n (%)	44640 (94.4)	1889 (97.0)	10327 (94.8)	4660 (92.4)	<0.001
Age (Years), n (%)					
0-9yrs, n (%)	1028 (2.2)	35 (1.8)	326 (3.0)	229 (4.5)	
10-14, n (%)	1606 (3.4)	24 (1.2)	242 (2.2)	153 (3.0)	
15-19, n (%)	1926 (4.1)	45 (2.3)	355 (3.3)	208 (4.1)	
20-24, n (%)	1768 (3.7)	54 (2.8)	756 (6.9)	429 (8.5)	
25-34, n (%)	6598 (14.0)	263 (13.5)	2707 (24.8)	1323 (26.2)	
35-44, n (%)	12240 (25.9)	509 (26.1)	2987 (27.4)	1406 (27.9)	
45-54, n (%)	12501 (26.4)	494 (25.4)	2060 (18.9)	776 (15.4)	
55-64, n (%)	7077 (15.0)	296 (15.2)	990 (9.1)	347 (6.9)	
65+, n (%)	2530 (5.4)	228 (11.7)	472 (4.3)	171 (3.4)	<0.001
Marital Status, n (%)					
Married, n (%)	21381 (45.2)	774 (39.7)	4391 (40.3)	2013 (39.9)	
Never married, n (%)	9474 (20.0)	436 (22.4)	2854 (26.2)	1394 (27.6)	
Polygamous, n (%)	2152 (4.6)	85 (4.4)	457 (4.2)	215 (4.3)	
Separated/Divorced, n (%)	3540 (7.5)	227 (11.7)	1164 (10.7)	442 (8.8)	
Unknown, n (%)	5788 (12.2)	181 (9.3)	1202 (11.0)	689 (13.7)	
Widowed, n (%)	4939 (10.4)	245 (12.6)	827 (7.6)	289 (5.7)	<0.001
Baseline WHO stage, n (%)					
Unstaged, n (%)	15973 (33.8)	514 (26.4)	2670 (24.5)	1178 (23.4)	
WHO Stage1, n (%)	26763 (56.6)	535 (27.5)	4157 (38.2)	2318 (46.0)	
WHO Stage2, n (%)	3427 (7.2)	417 (21.4)	2472 (22.7)	1040 (20.6)	
WHO Stage3, n (%)	1043 (2.2)	407 (20.9)	1427 (13.1)	464 (9.2)	
WHO Stage4, n (%)	68 (0.1)	75 (3.9)	169 (1.6)	42 (0.8)	<0.001
BMI category, n (%)					
Underweight, n (%)	4746 (10.0)	672 (34.5)	2412 (22.1)	986 (19.6)	
Normal weight, n (%)	14824 (31.4)	503 (25.8)	4317 (39.6)	2031 (40.3)	
Overweight, n (%)	6579 (13.9)	106 (5.4)	1055 (9.7)	554 (11.0)	
Obese, n (%)	3477 (7.4)	53 (2.7)	509 (4.7)	265 (5.3)	
Not Indicated, n (%)	17648 (37.3)	614 (31.5)	2602 (23.9)	1206 (23.9)	<0.001
Population type, n (%)					
General Population, n (%)	39574 (83.7)	335 (17.2)	1024 (9.4)	665 (13.2)	
Key Population, n (%)	407 (0.9)	1 (0.1)	44 (0.4)	9 (0.2)	
Unknown, n (%)	7293 (15.4)	1612 (82.8)	9827 (90.2)	4368 (86.6)	<0.001
TB Status, n (%)					

No TB Signs, n (%)	39659 (83.9)	298 (15.3)	1047 (9.6)	652 (12.9)	
Presumed TB, n (%)	81 (0.2)	13 (0.7)	9 (0.1)	3 (0.1)	
TB Confirmed, n (%)	12 (0.0)	6 (0.3)	0 (0.0)	0 (0.0)	
Unknown, n (%)	7522 (15.9)	1631 (83.7)	9839 (90.3)	4387 (87.0)	<0.001
Baseline Core Regimen, n (%)					
ABC Based, n (%)	6840 (14.5)	234 (12.0)	1356 (12.5)	558 (11.1)	
AZT Based, n (%)	3075 (6.5)	80 (4.1)	538 (4.9)	363 (7.2)	
D4T Based, n (%)	4114 (8.7)	157 (8.1)	830 (7.6)	186 (3.7)	
TDF Based, n (%)	27251 (57.8)	1268 (65.3)	7103 (65.2)	3580 (71.1)	
Other, n (%)	5839 (12.4)	203 (10.5)	1059 (9.7)	346 (6.9)	<0.001
Current Core Regimen, n (%)					
ABC Based, n (%)	2345 (5.0)	165 (8.5)	1314 (12.1)	434 (8.6)	
AZT Based, n (%)	2492 (5.3)	126 (6.5)	551 (5.1)	354 (7.0)	
TDF Based, n (%)	42079 (89.1)	1499 (77.2)	7980 (73.3)	3957 (78.7)	
Other, n (%)	336 (0.7)	152 (7.8)	1042 (9.6)	285 (5.7)	<0.001
Baseline Viral suppression [<1000 copies/ml], n (%)					
<1000 copies/ml, n (%)	39520 (83.6)	701 (36.0)	3691 (33.9)	2282 (45.3)	
>=1000 copies/ml, n (%)	4106 (8.7)	200 (10.3)	595 (5.5)	356 (7.1)	
No VL done, n (%)	3648 (7.7)	1047 (53.7)	6609 (60.7)	2404 (47.7)	<0.001
Current Viral suppression, n (%)					
<1000 copies/ml, n (%)	42129 (89.1)	723 (37.1)	4177 (38.3)	2750 (54.5)	
>=1000 copies/ml, n (%)	2035 (4.3)	202 (10.4)	630 (5.8)	398 (7.9)	
No VL done, n (%)	3110 (6.6)	1023 (52.5)	6088 (55.9)	1894 (37.6)	<0.001
Has Comorbidity/Chronic illness, n (%)					
No, n (%)	39707 (84.0)	333 (17.1)	1065 (9.8)	673 (13.3)	
Unknown, n (%)	7293 (15.4)	1608 (82.5)	9817 (90.1)	4362 (86.5)	
Yes, n (%)	274 (0.6)	7 (0.4)	13 (0.1)	7 (0.1)	<0.001
Time on ART, n (%)					
0-6 months, n (%)	0 (0.0)	681 (35.0)	3244 (29.8)	1604 (31.8)	
7-12 months, n (%)	0 (0.0)	126 (6.5)	625 (5.7)	552 (10.9)	
>12 months, n (%)	47274 (100.0)	1141 (58.6)	7026 (64.5)	2886 (57.2)	<0.001
Last ART Status, n (%)					
Active, n (%)	47274 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Dead, n (%)	0 (0.0)	1948 (100.0)	0 (0.0)	0 (0.0)	
Lost to follow up, n (%)	0 (0.0)	0 (0.0)	10895 (100.0)	0 (0.0)	
Transferred out, n (%)	0 (0.0)	0 (0.0)	0 (0.0)	5042 (100.0)	<0.001

Viral suppression outcomes among HIV positive clients on ART

Overall, 49,779 (93.8%) HIV cliets were suppressed and 3,265 (6.2%) were non-suppressed. The median age of those who were non-suppressed was lower than those who were suppressed,35.82 (IQI: 20.38; 46.70) vs. 44.04 (IQI: 34.47; 52.96) , p <0.001. There was a higher proportion of males among non-suppressed compared to suppressed, 1,242 (38.0%) vs. 1,4825 (29.8%), p <0.001. There was a higher proportion of children among the non-suppressed compared to those suppressed, 445 (13.6%) vs. 2636 (5.3%), p <0.001. There were higher proportions of HIV positive clients in age categories 34 years or under who were non-suppressed compared to those suppressed, p <0.001. Results showed a higher proportion of non-suppressed HIV clients were never married compared to those suppressed, 1095 (33.5%) vs. 9951 (20.0%), p <0.001. Higher proportions of non-suppressed clients were mostly in HIV WHO stage 3 and 4 at baseline, 215 (6.6%) vs. 1586 (3.2%) and 31 (0.9%) and 132 (0.3%) respectively, all p values <0.001.

There were higher proportions of non-suppressed clients on ABC and AZT baseline core regimens, 610 (18.7%) vs. 7445 (15.0%) and 516 (15.9%) vs. 3018 (6.1%) respectively, all p values <0.001. Similarly, there were higher proportions of non-suppressed clients on ABC and AZT current core regimens, 579 (17.8%) vs. 2671 (5.4%) and 415 (12.7%) vs. 2549 (5.1%) respectively, all p values <0.001. A higher proportion of current non-suppressed clients were non-suppressed at baseline compared to those who were suppressed at baseline, 1471 (45.1%) vs. 3786 (7.6%), p value <0.001. A higher proportion of non-suppressed clients were on ART for 6 months or less and 7 to 12 months compared to the suppressed, 174 (5.3%) vs. 1371 (2.8%) and 95 (2.9%) vs. 543 (1.1%), all p values <0.001, as shown in Table 13.

Table 13: Viral suppression outcomes among HIV positive clients on ART, October 2016 to March 2021

Columns by: Current Viral suppression	Non-suppressed (>=1000 copies/ml)	Suppressed (<1000 copies/ml)	Total	P-value
n (%)	**3265 (6.2)**	**49779 (93.8)**	**53044 (100.0)**	
Sex, n (%)				
Female, n (%)	2023 (62.0)	34954 (70.2)	36977 (69.7)	
Male , n (%)	1242 (38.0)	14825 (29.8)	16067 (30.3)	<0.001
Age (Years), median (iqi)	35.82 (20.38; 46.70)	44.04 (34.47; 52.96)	43.96 (33.96; 52.96)	<0.001
Adult Category, n (%)				
Child, n (%)	445 (13.6)	2636 (5.3)	3081 (5.8)	

Adult, n (%)	2820 (86.4)	47143 (94.7)	49963 (94.2)	<0.001
Age Categories (Years), n (%)				
0-9yrs, n (%)	211 (6.5)	1044 (2.1)	1255 (2.4)	
10-14, n (%)	234 (7.2)	1592 (3.2)	1826 (3.4)	
15-19, n (%)	361 (11.1)	1837 (3.7)	2198 (4.1)	
20-24, n (%)	263 (8.1)	1819 (3.7)	2082 (3.9)	
25-34, n (%)	534 (16.4)	7088 (14.2)	7622 (14.4)	
35-44, n (%)	767 (23.5)	12967 (26.0)	13734 (25.9)	
45-54, n (%)	537 (16.4)	13129 (26.4)	13666 (25.8)	
55-64, n (%)	257 (7.9)	7461 (15.0)	7718 (14.6)	
65+, n (%)	101 (3.1)	2842 (5.7)	2943 (5.5)	<0.001
Marital Status, n (%)				
Married, n (%)	1131 (34.6)	22468 (45.1)	23599 (44.5)	
Never married, n (%)	1095 (33.5)	9951 (20.0)	11046 (20.8)	
Polygamous, n (%)	104 (3.2)	2374 (4.8)	2478 (4.7)	
Separated/Divorced, n (%)	203 (6.2)	3782 (7.6)	3985 (7.5)	
Unknown, n (%)	540 (16.5)	5969 (12.0)	6509 (12.3)	
Widowed, n (%)	192 (5.9)	5235 (10.5)	5427 (10.2)	<0.001
Baseline WHO stage, n (%)				
Unstaged, n (%)	1063 (32.6)	15819 (31.8)	16882 (31.8)	
WHO Stage1, n (%)	1517 (46.5)	27536 (55.3)	29053 (54.8)	
WHO Stage2, n (%)	439 (13.4)	4706 (9.5)	5145 (9.7)	
WHO Stage3, n (%)	215 (6.6)	1586 (3.2)	1801 (3.4)	
WHO Stage4, n (%)	31 (0.9)	132 (0.3)	163 (0.3)	<0.001
BMI category, n (%)				
Underweight, n (%)	742 (22.7)	5507 (11.1)	6249 (11.8)	
Normal weight, n (%)	964 (29.5)	16354 (32.9)	17318 (32.6)	
Overweight, n (%)	275 (8.4)	6968 (14.0)	7243 (13.7)	
Obese, n (%)	116 (3.6)	3715 (7.5)	3831 (7.2)	
Not Indicated, n (%)	1168 (35.8)	17235 (34.6)	18403 (34.7)	<0.001
Population type, n (%)				
General Population, n (%)	1824 (55.9)	36565 (73.5)	38389 (72.4)	
Key Population, n (%)	19 (0.6)	294 (0.6)	313 (0.6)	
Unknown, n (%)	1422 (43.6)	12920 (26.0)	14342 (27.0)	<0.001
TB Status, n (%)				
No TB Signs, n (%)	1819 (55.7)	36663 (73.7)	38482 (72.5)	
Presumed TB, n (%)	11 (0.3)	61 (0.1)	72 (0.1)	
TB Confirmed, n (%)	1 (0.0)	4 (0.0)	5 (0.0)	
Unknown, n (%)	1434 (43.9)	13051 (26.2)	14485 (27.3)	<0.001
Baseline Core Regimen, n (%)				

ABC Based, n (%)	610 (18.7)	7445 (15.0)	8055 (15.2)	
AZT Based, n (%)	516 (15.9)	3018 (6.1)	3534 (6.7)	
D4T Based, n (%)	236 (7.3)	4498 (9.1)	4734 (9.0)	
TDF Based, n (%)	1608 (49.4)	28232 (56.9)	29840 (56.4)	
Other, n (%)	285 (8.8)	6426 (13.0)	6711 (12.7)	<0.001
Current Core Regimen, n (%)				
ABC Based, n (%)	579 (17.8)	2671 (5.4)	3250 (6.1)	
AZT Based, n (%)	415 (12.7)	2549 (5.1)	2964 (5.6)	
TDF Based, n (%)	2184 (67.0)	43665 (87.8)	45849 (86.5)	
Other, n (%)	81 (2.5)	861 (1.7)	942 (1.8)	<0.001
Baseline Viral suppression [<1000 copies/ml], n (%)				
<1000 copies/ml, n (%)	1624 (49.7)	44570 (89.5)	46194 (87.1)	
>=1000 copies/ml, n (%)	1471 (45.1)	3786 (7.6)	5257 (9.9)	
No VL done, n (%)	170 (5.2)	1423 (2.9)	1593 (3.0)	<0.001
Current Viral suppression, n (%)				
<1000 copies/ml, n (%)	0 (0.0)	49779 (100.0)	49779 (93.8)	
>=1000 copies/ml, n (%)	3265 (100.0)	0 (0.0)	3265 (6.2)	<0.001
Has Comorbidity/Chronic illness, n (%)				
No, n (%)	1832 (56.1)	36601 (73.5)	38433 (72.5)	
Unknown, n (%)	1422 (43.6)	12904 (25.9)	14326 (27.0)	
Yes, n (%)	11 (0.3)	274 (0.6)	285 (0.5)	<0.001
Time on ART, n (%)				
0-6 months, n (%)	174 (5.3)	1371 (2.8)	1545 (2.9)	
7-12 months, n (%)	95 (2.9)	543 (1.1)	638 (1.2)	
>12 months, n (%)	2996 (91.8)	47865 (96.2)	50861 (95.9)	<0.001

Factors associated with viral un-suppression among HIV positive clients on ART, October 2016 to March 2021

On univariable analysis, characteristics associated with higher odds of viral non-suppression were male sex compared to females; age categories 0-9, 10-14, 15-19, 20-24, 25 - 34, and 35-44 years compared to those 65 years and above, clients who were never married or with unknown marital status compared to those who were married; non-suppressed or unknown viral suppression status; ; underweight BMI status; HIV WHO stage 3, 4 or un-staged compared to HIV WHO stage 1; those on ABC and AZT based regimens at baseline as the core regimens compared to TDF based regimens; ABC, AZT, D4T, and other based current core regimens compared to TDF based; and on ART regimens for 7-12 months.

On multivariable analysis, male sex compared to females was significantly associated with higher odds of viral non-suppression, aOR = 1.14 (95% CI: 1.05-1.25). Age categories 0-9, 10-14, 15-19, 20-24, 25-34, and 35-44 compared to those 65 years and above were also significantly associated with higher odds of viral non-suppression aOR = 1.91 (95% CI: 1.29-2.84), aOR = 1.80 (95% CI: 1.23-2.63), aOR = 2.97 (95% CI: 2.13-4.15), aOR = 2.46 (95% CI: 1.72-3.54), aOR = 1.86 (95% CI: 1.41-2.46), and aOR = 1.49 (95% CI: 1.15-1.91) respectively. Clients categorized as WHO stage 3, 4 or un-staged at baseline compared to WHO stage 1 also still had significantly higher odds of viral non-suppression, aOR = 1.46 (95% CI: 1.11-1.91), aOR = 1.85 (95% CI: 1.40-2.44) and aOR = 2.91 (95% CI: (1.87-4.53) respectively. HIV positive clients on ABC, AZT, and other current core regimen compared to TDF based had significantly higher odds of viral non-suppression, aOR = 1.79 (95% CI: 1.56-2.06), aOR = 1.29 (95%CI: 1.07-1.54), and aOR = 1.48 (95%CI: 1.16-1.88) respectively. Those with non-suppressed viral load or unknown viral suppression at baseline had significantly higher odds of current viral non-suppression, aOR = 7.97 (95% CI: 6.67-9.51) and aOR = 1.84 (95% CI: 1.39-2.45) respectively. Also, those with known or unknown comorbidity or chronic illness compared to those without had significantly higher odds of non-suppression, aOR = 1.88 (95%CI: 1.50-2.36) and aOR = 1.58 (95%CI: 1.04-2.40) respectively as shown in Table 14.

Table 14: Factors associated with viral un-suppression among HIV positive clients on ART, October 2016 to March 2021

Outcome: Current Viral non-suppression (VL >1000 copies/ml)	Univariable OR (95% CI)	P value	Multivariable aOR (95% CI)	P value
Sex				
Female	Reference		Reference	
Male	1.45 (1.34-1.57)	<0.001	1.14 (1.05-1.25)	0.004
Age category (Years)				
0-9	5.69 (4.20-7.70)	<0.001	1.91 (1.29-2.84)	0.001
10-14	4.14 (3.11-5.50)	<0.001	1.80 (1.23-2.63)	0.003
15-19	5.53 (4.15-7.37)	<0.001	2.97 (2.13-4.15)	<0.001
20-24	4.07 (2.85-5.81)	<0.001	2.46 (1.72-3.54)	<0.001

25-34	2.12 (1.64-2.74)	<0.001	1.86 (1.41-2.46)	<0.001
35-44	1.66 (1.31-2.11)	<0.001	1.49 (1.15-1.91)	0.002
45-54	1.15 (0.93-1.42)	0.194	1.14 (0.90-1.44)	0.281
55-64	0.97 (0.77-1.23)	0.795	1.00 (0.77-1.30)	0.985
65+	Reference		Reference	
Marital Status				
Married	Reference		Reference	
Never married	2.19 (1.95-2.45)	<0.001	1.09 (0.98-1.21)	0.115
Polygamous	0.87 (0.72-1.06)	0.159	0.99 (0.82-1.20)	0.93
Separated/Divorced	1.07 (0.92-1.23)	0.378	1.02 (0.89-1.18)	0.76
Unknown	1.80 (1.54-2.09)	<0.001	1.12 (0.94-1.34)	0.202
Widowed	0.73 (0.62-0.85)	<0.001	0.93 (0.78-1.11)	0.408
WHO stage				
WHO Stage1	Reference		Reference	
WHO Stage2	0.82 (0.70-0.96)	0.015	1.15 (0.92-1.43)	0.216
WHO Stage3	1.39 (1.09-1.77)	0.008	1.46 (1.11-1.91)	0.006
WHO Stage4	2.02 (1.48-2.75)	<0.001	1.85 (1.40-2.44)	<0.001
Un-staged	3.49 (2.08-5.86)	<0.001	2.91 (1.87-4.53)	<0.001
BMI				
Normal weight	Reference		Reference	
Underweight	2.29 (2.02-2.59)	<0.001	1.34 (1.19-1.51)	<0.001
Overweight	0.67 (0.56-0.80)	<0.001	0.87 (0.74-1.02)	0.089
Obese	0.53 (0.44-0.64)	<0.001	0.75 (0.62-0.90)	0.002
Not Indicated	1.15 (0.96-1.37)	0.122	1.13 (0.94-1.36)	0.206
Baseline core regimen				
TDF Based	Reference		Reference	
ABC Based	1.44 (1.23-1.68)	<0.001	0.92 (0.79-1.09)	0.343
AZT Based	3.00 (2.71-3.32)	<0.001	0.95 (0.79-1.16)	0.638
D4T Based	0.92 (0.75-1.12)	0.42	0.84 (0.67-1.06)	0.141
Other	0.78 (0.67-0.91)	0.001	0.85 (0.73-0.99)	0.033
Current core regimen				
TDF Based	Reference		Reference	
ABC Based	4.33 (3.83-4.90)	<0.001	1.79 (1.56-2.06)	<0.001
AZT Based	3.26 (2.83-3.75)	<0.001	1.29 (1.07-1.54)	0.007
Other	1.88 (1.41-2.50)	<0.001	1.48 (1.16-1.88)	0.001

Baseline Viral Load				
<1000 copies/ml	Reference		Reference	
>=1000 copies/ml	10.66 (9.09-12.51)	<0.001	7.97 (6.67-9.51)	<0.001
No VL result	3.28 (2.65-4.06)	<0.001	1.84 (1.39-2.45)	<0.001
Comorbidity/ Chronic Illness				
No	Reference		Reference	
Unknown	2.20 (1.77-2.73)	<0.001	1.88 (1.50-2.36)	<0.001
Yes	0.80 (0.52-1.23)	0.314	1.58 (1.04-2.40)	0.032
Time on ART (months)				
0-6 months	Reference		Reference	
7-12 months	1.38 (1.05-1.81)	0.021	1.22 (0.92-1.62)	0.168
>12 months	0.49 (0.39-0.62)	<0.001	0.86 (0.69-1.08)	0.187

Characteristics of clients associated with loss to follow up (LTFU), October 2016 to March 2021

On univariable analysis, characteristics significantly associated with higher risk of being LTFU were; male sex, age categories 10-14 years, and 25 to 64 years compared to those aged 65 years and above. Those who were in polygamous or separated/divorced union compared to being married; non-suppressed or unknown viral suppression status at both baseline and currently compared to those who were suppressed; un-staged, HIV WHO stage 3 and 4 compared to HIV WHO stage 1; and other current core regimens compared to ABC based regimens.

On multivariable analysis, age categories 25 to 34 and 35 to 44 compared to age 65 and above were significantly associated with higher risk of being LTFU aSHR = 1.54 (95% CI: 1.35-1.75) and aSHR = 1.17 (95%CI: 1.07-1.28) respectively. Those who had a baseline WHO stage 2 and 4 or un-staged, aSHR = 1.82 (95% CI: 1.37-2.42), aSHR = 1.75 (95% CI: 1.39-2.20), and aSHR = 1.81 (95%CI: 1.30-2.51) respectively. HIV positive clients on D4T based baseline and Other current core regimen compared to ABC based core regimen had significantly higher risk being LTFU, aSHR = 1.28 (95%CI: 1.12-1.47), and aSHR = 1.28 (95%CI: 1.11-1.47),) respectively. Those with a last non-suppressed viral suppression status and unknown baseline viral suppression had significantly higher risk of being LTFU, aSHR=1.90 (95% CI: 1.63-2.21), aSHR = 3.23 (95% CI: 2.49-4.17) and aSHR =1.79 (95%CI: 1.56-2.06) respectively as indicated in Table 15.

The cumulative incidence plot shows the proportion of cumulative incidence of LTFU over time in months since initiating ART, Figure 10.

Table 15: Characteristics associated with loss to follow up (LTFU) among HIV positive clients on ART, October 2016 to March 2021

	Univariable		Multivariable	
Outcome: LTFU	**SHR (95% CI)**	**P value**	**SHR (95% CI)**	**P value**
Sex				
Female	Reference		Reference	
Male	1.13 (1.07-1.20)	<0.001	1.04 (0.99-1.08)	0.122
Age category (Years)				
0-9	1.56 (1.06-2.28)	0.001	1.36 (0.89-2.08)	0.122
10-14	0.86 (0.71-1.04)	0.016	1.03 (0.81-1.30)	0.151
15-19	1.01 (0.85-1.21)	0.066	1.04 (0.87-1.23)	0.823
20-24	2.01 (1.55-2.61)	0.077	1.49 (1.24-1.78)	0.690
25-34	2.01 (1.65-2.44)	0.266	1.54 (1.35-1.75)	<.001
35-44	1.31 (1.15-1.49)	0.006	1.17 (1.07-1.28)	<.001
45-54	0.94 (0.87-1.02)	0.002	0.98 (0.91-1.06)	0.001
55-64	0.81 (0.73-0.90)	0.023	0.92 (0.84-1.02)	0.628
65+	Reference		Reference	
Marital Status				
Married	Reference		Reference	
Never married	0.98 (0.88-0.91)	0.756	0.88 (0.80-1.02)	0.015
Polygamous	1.32 (1.17-0.67)	<.001	0.93 (0.82-0.95)	0.272
Separated/Divorced	1.43 (1.25-1.63)	<.001	0.99 (0.89-1.11)	0.890
Unknown	1.00 (0.83-1.19)	0.954	0.94 (0.81-1.10)	0.444
Widowed	0.82 (0.66-1.01)	0.064	0.86 (0.73-1.01)	0.064
WHO stage				
WHO Stage1	Reference		Reference	
WHO Stage2	0.95 (0.61-1.50)	0.154	0.98 (0.73-1.33)	0.573
WHO Stage3	2.90 (1.86-4.50)	<.001	1.82 (1.37-2.42)	<.001
WHO Stage4	3.77 (2.65-5.35)	<.001	1.75 (1.39-2.20)	<.001
Unstaged	4.29 (2.87-6.45)	<.001	1.81 (1.30-2.51)	<.001

BMI				
Normal weight	Reference		Reference	
Underweight	1.41 (1.26-0.63)	<.001	1.03 (0.96-0.90)	0.444
Overweight	0.61 (0.57-0.66)	<.001	0.81 (0.76-0.87)	<.001
Obese	0.56 (0.52-0.62)	<.001	0.82 (0.76-0.89)	<.001
Not Indicated	0.56 (0.41-0.77)	0.002	0.67 (0.56-0.80)	<.001
Initial core regimen				
ABC Based	Reference		Reference	
AZT Based	0.90 (0.66-1.23)	0.507	0.77 (0.62-0.95)	0.015
D4T Based	1.01 (0.82-1.26)	0.901	0.99 (0.87-1.13)	0.900
TDF Based	1.30 (0.98-1.72)	0.067	1.28 (1.12-1.47)	<0.001
Other	0.95 (0.77-1.16)	0.592	0.94 (0.84-1.04)	0.237
Current core regimen				
ABC Based	Reference		Reference	
AZT Based	0.51 (0.37-0.69)	<.001	0.74 (0.62-0.88)	0.001
TDF Based	0.47 (0.35-0.63)	<.001	0.52 (0.46-0.59)	<.001
Other	2.00 (1.55-2.59)	<.001	1.28 (1.11-1.47)	0.001
First Viral Load				
<1000 copies/ml	Reference		Reference	
>=1000 copies/ml	1.44 (1.19-1.74)	<.001	0.95 (0.81-1.13)	0.587
Not done	7.81 (6.37-9.52)	<.001	3.23 (2.49-4.17)	<.0001
Last Viral Load				
<1000 copies/ml	Reference		Reference	
>=1000 copies/ml	2.43 (2.02-2.92)	<.001	1.90 (1.63-2.21)	<.001
Not done	7.87 (6.62-9.35)	<.001	1.79 (1.56-2.06)	<.001

* omitted due to multicollinearity

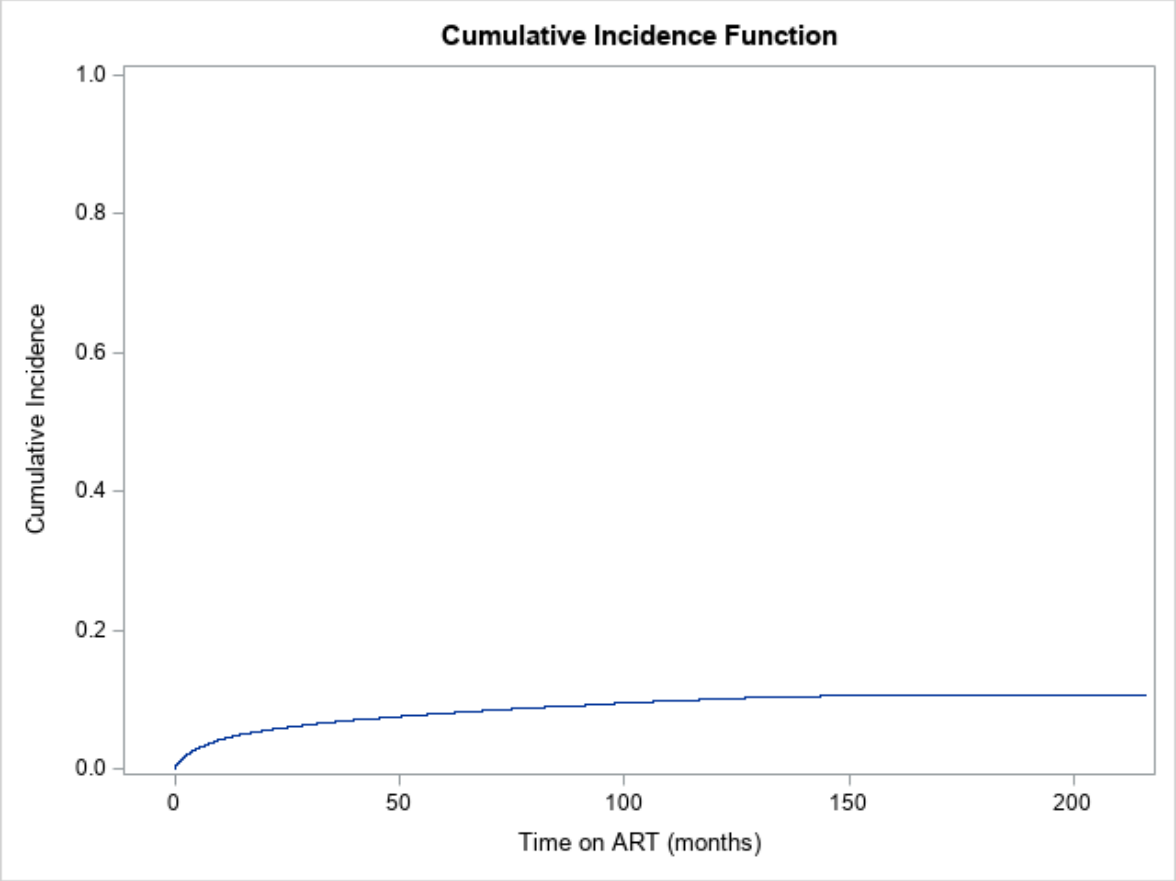

Figure 10: Cumulative incidence of LTFU over time in months since initiating ART

Mortality outcome among HIV positive clients on ART, , October 2016 to March 2021

Overall, 3,816 (5.9%) HIV positive clients on ART died and 60940 (94.1%) were censored. The median time on ART was 27.3 months (IQI: 7.9 - 69.1).

The median age of those who died was higher than those who were censored, 45.96 vs. 42.9 years, p <0.001. There was a higher proportion of males among those who died compared to those who were censored, 807 (41.4%) vs. 19499 (30.8%). There was a higher proportion of adults among those who died compared to those censored, 1889 (97.0%) vs. 59627 (94.3%). Results showed higher proportions of HIV positive clients in age categories over 44 years who died compared to those censored. There was also a higher proportion of mortality among clients who were separated or divorced and widowed compared to those censored.

Results also showed that higher proportions of clients in HIV WHO stage 2, 3 and 4 at baseline among those who died compared to the censored group, 417 (21.4%) vs. 6939 (11.0), 407 (20.9%) vs. 2934 (4.6%), and 75 (3.9%) vs. 279 (0.4%)) respectively. There were higher proportions of clients on ABC, AZT and Other current core regimens who died. There was a higher proportion of clients who died without a viral load result and non-suppressed at baseline compared to those who were censored, 202 (10.4%) vs. 3063 (4.8%), 1023 (52.5%) vs. 11092 (17.5%). Similarly, a higher proportion of clients who died without a viral load result and non-suppressed at last viral load done compared to those who were censored, 202 (10.4%) vs. 3063 (4.8%), 1023 (52.5%) vs. 11092 (17.5%). There was a higher proportion of clients who died and were on ART for six months or less compared to those censored, 681 (35.0%) vs. 4848 (7.7%), as shown in Table 16.

Table 16: Characteristics by mortality outcome among HIV positive clients on ART, October 2016 to March 2021

Columns by: Death only outcome	**Died**	**Censored**	**Total**
n (%)	**1948 (3.0)**	**63211 (97.0)**	**65159 (100.0)**
Age (Years), median (iqi)	45.96 (36.95; 56.93)	42.90 (32.67; 51.96)	42.96 (32.88; 51.96)
Sex, n (%)			
F, n (%)	1141 (58.6)	43712 (69.2)	44853 (68.8)
M, n (%)	807 (41.4)	19499 (30.8)	20306 (31.2)
Adult Category, n (%)			
Child, n (%)	59 (3.0)	3584 (5.7)	3643 (5.6)
Adult, n (%)	1889 (97.0)	59627 (94.3)	61516 (94.4)
Age Category (Years), n (%)			
0-9 , n (%)	35 (1.8)	1583 (2.5)	1618 (2.5)
10-14, n (%)	24 (1.2)	2001 (3.2)	2025 (3.1)
15-19, n (%)	45 (2.3)	2489 (3.9)	2534 (3.9)
20-24, n (%)	54 (2.8)	2953 (4.7)	3007 (4.6)
25-34, n (%)	263 (13.5)	10628 (16.8)	10891 (16.7)
35-44, n (%)	509 (26.1)	16633 (26.3)	17142 (26.3)
45-54, n (%)	494 (25.4)	15337 (24.3)	15831 (24.3)
55-64, n (%)	296 (15.2)	8414 (13.3)	8710 (13.4)
65+, n (%)	228 (11.7)	3173 (5.0)	3401 (5.2)
Marital Status, n (%)			
Married, n (%)	774 (39.7)	27785 (44.0)	28559 (43.8)
Never married, n (%)	436 (22.4)	13722 (21.7)	14158 (21.7)

Polygamous, n (%)	85 (4.4)	2824 (4.5)	2909 (4.5)
Separated/Divorced, n (%)	227 (11.7)	5146 (8.1)	5373 (8.2)
Unknown, n (%)	181 (9.3)	7679 (12.1)	7860 (12.1)
Widowed, n (%)	245 (12.6)	6055 (9.6)	6300 (9.7)
Baseline WHO stage, n (%)			
Unstaged, n (%)	514 (26.4)	19821 (31.4)	20335 (31.2)
WHO Stage1, n (%)	535 (27.5)	33238 (52.6)	33773 (51.8)
WHO Stage2, n (%)	417 (21.4)	6939 (11.0)	7356 (11.3)
WHO Stage3, n (%)	407 (20.9)	2934 (4.6)	3341 (5.1)
WHO Stage4, n (%)	75 (3.9)	279 (0.4)	354 (0.5)
BMI category, n (%)			
Underweight, n (%)	672 (34.5)	8144 (12.9)	8816 (13.5)
Normal weight, n (%)	503 (25.8)	21172 (33.5)	21675 (33.3)
Overweight, n (%)	106 (5.4)	8188 (13.0)	8294 (12.7)
Obese, n (%)	53 (2.7)	4251 (6.7)	4304 (6.6)
Not Indicated, n (%)	614 (31.5)	21456 (33.9)	22070 (33.9)
Population type, n (%)			
General Population, n (%)	335 (17.2)	41263 (65.3)	41598 (63.8)
Key Population, n (%)	1 (0.1)	460 (0.7)	461 (0.7)
Unknown, n (%)	1612 (82.8)	21488 (34.0)	23100 (35.5)
TB Status, n (%)			
No TB Signs, n (%)	298 (15.3)	41358 (65.4)	41656 (63.9)
Presumed TB, n (%)	13 (0.7)	93 (0.1)	106 (0.2)
TB Confirmed, n (%)	6 (0.3)	12 (0.0)	18 (0.0)
Unknown, n (%)	1631 (83.7)	21748 (34.4)	23379 (35.9)
Baseline Core Regimen, n (%)			
ABC Based, n (%)	234 (12.0)	8754 (13.9)	8988 (13.8)
AZT Based, n (%)	80 (4.1)	3976 (6.3)	4056 (6.2)
D4T Based, n (%)	157 (8.1)	5130 (8.1)	5287 (8.1)
TDF Based, n (%)	1268 (65.3)	37934 (60.2)	39202 (60.3)
Other, n (%)	203 (10.5)	7244 (11.5)	7447 (11.5)
Current Core Regimen, n (%)			
ABC Based, n (%)	165 (8.5)	4093 (6.5)	4258 (6.5)
AZT Based, n (%)	126 (6.5)	3397 (5.4)	3523 (5.4)
TDF Based, n (%)	1499 (77.2)	54016 (85.5)	55515 (85.3)
Other, n (%)	152 (7.8)	1663 (2.6)	1815 (2.8)
Baseline Viral suppression [<1000 copies/ml], n (%)			
<1000 copies/ml, n (%)	701 (36.0)	45493 (72.0)	46194 (70.9)
>=1000 copies/ml, n (%)	200 (10.3)	5057 (8.0)	5257 (8.1)
No VL done, n (%)	1047 (53.7)	12661 (20.0)	13708 (21.0)

Last Viral suppression, n (%)			
<1000 copies/ml, n (%)	723 (37.1)	49056 (77.6)	49779 (76.4)
>=1000 copies/ml, n (%)	202 (10.4)	3063 (4.8)	3265 (5.0)
No VL done, n (%)	1023 (52.5)	11092 (17.5)	12115 (18.6)
Has Comorbidity/Chronic illness, n (%)			
No, n (%)	333 (17.1)	41445 (65.6)	41778 (64.1)
Unknown, n (%)	1608 (82.5)	21472 (34.0)	23080 (35.4)
Yes, n (%)	7 (0.4)	294 (0.5)	301 (0.5)
Time on ART, n (%)			
0-6 months, n (%)	681 (35.0)	4848 (7.7)	5529 (8.5)
7-12 months, n (%)	126 (6.5)	1177 (1.9)	1303 (2.0)
>12 months, n (%)	1141 (58.6)	57186 (90.5)	58327 (89.5)

Characteristics associated with mortality outcome among HIV positive clients on ART, October 2016 to March 2021

On univariable analysis, characteristics significantly associated with higher risk of mortality were: male sex; age categories ages 55 to 64 and 65 and above compared to those aged 0 to 9 years; Those who had a polygamous or separated/divorced, never married and widowed marital status compared to the married; Un-staged clients, WHO stage 3 and WHO stage 4 compared to WHO stage 1; underweight BMI; non-suppressed or unknown viral suppression status at both baseline and currently compared to those who were suppressed; and D4T based baseline core regimen and Other current core based regimen compared to TDF based core regimen.

On multivariable analysis, male sex aSHR = 1.29 (95% CI: 1.09-1.52) and age categories 20 to 24, 25 to 34, 35 to 44, 45 to 54, 55 to 64, and 65+ years compared to those 0 to 9 years old were significantly associated with higher risk of mortality. Those clients who were never married, separated or divorced, and widowed had significantly higher risk of mortality compared to married clients, aSHR = 1.29 (95% CI: 1.09-1.52), aSHR = 1.23 (95% CI: 1.05-1.43), and aSHR = 1.24 (95% CI:1.04-1.48) respectively. Those with a baseline WHO stage 2, 3, 4 or un-staged also had significantly higher risk of mortality, aSHR = 1.61 (95% CI: 1.13-2.29), aSHR = 2.24 (95% CI: 1.61-3.10), aSHR = 3.12 (95% CI: 2.42-4.01), and aSHR = 4.01 (95% CI: 2.92-5.52) respectively. Those with underweight BMI category had higher risk of mortality compared to those with normal weight, aSHR =2.31 (95% CI: 2.08-2.56). HIV positive clients on current ABC and AZT based core

regimen compared to TDF based core regimen had significantly higher risk of mortality, aSHR = 2.84 (95%CI: 2.18-3.69) and aSHR = 1.30 (95%CI: 1.02-1.66) respectively. Those with a baseline non-suppressed viral suppression status, last non-suppressed viral suppression status and no viral load results had significantly higher risk of mortality, aSHR = 1.51 (95%CI: 1.20-1.90), aSHR = 2.47 (95%CI: 1.98-3.08), and aSHR =5.73 (3.48-9.44) respectively. Clients with a comorbidity or those with unknown comorbidity status had significantly higher risk of mortality, aSHR = 2.60 ((95% CI: 1.13-5.97) and aSHR = 6.20 ((95% CI: 4.22-9.09) respectively as shown in Table 16.

Table 16: Characteristics by mortality outcome among HIV positive clients on ART, October 2016 to March 2021

	Univariable		Multivariable	
Outcome: Mortality	SHR (95% CI)	P value	a SHR (95% CI)	P value
Gender coded				
Female	Reference		Reference	
Male	1.58 (1.45-1.72)	<0.001	1.58 (1.45-1.72)	<0.001
Age category				
0-9	Reference		Reference	
10-14	0.53 (0.29-0.94)	0.030	0.82 (0.48-1.41)	0.471
15-19	0.78 (0.44-1.38)	0.394	1.65 (0.86-3.17)	0.135
20-24	0.84 (0.50-1.41)	0.503	1.84 (1.05-3.21)	0.033
25-34	1.15 (0.79-1.66)	0.477	2.99 (1.93-4.63)	<0.001
35-44	1.36 (0.93-1.99)	0.118	4.28 (2.77-6.60)	<0.001
45-54	1.40 (0.94-2.10)	0.100	5.48 (3.45-8.72)	<0.001
55-64	1.50 (1.03-2.20)	0.035	6.51 (4.34-9.77)	<0.001
65+	3.03 (2.04-4.51)	<0.001	10.80 (6.86-17.00)	<0.001
Marital Status				
Married	Reference		Reference	
Never married	1.16 (1.01-1.32)	0.037	1.29 (1.09-1.52)	0.003
Polygamous	1.08 (0.85-1.38)	0.541	0.98 (0.75-1.28)	0.876
Separated/Divorced	1.60 (1.39-1.84)	<0.001	1.23 (1.05-1.43)	0.011
Unknown	0.88 (0.73-1.07)	0.210	1.13 (0.90-1.41)	0.287
Widowed	1.43 (1.22-1.68)	<0.001	1.24 (1.04-1.48)	0.016
WHO stage				
WHO Stage1	Reference		Reference	

WHO Stage2	0.63 (0.46-0.86)	0.003	1.61 (1.13-2.29)	0.008
WHO Stage3	2.31 (1.60-3.35)	<0.001	2.24 (1.61-3.10)	<0.001
WHO Stage4	5.22 (3.77-7.24)	<0.001	3.12 (2.42-4.01)	<0.001
Unstaged	9.67 (6.55-14.28)	<0.001	4.01 (2.92-5.52)	<0.001
BMI Category				
Normal weight	Reference		Reference	
Underweight	3.42 (3.05-3.82)	<0.001	2.31 (2.08-2.56)	<0.001
Overweight	0.54 (0.41-0.72)	<0.001	0.81 (0.61-1.07)	0.133
Obese	0.52 (0.41-0.66)	<0.001	0.81 (0.63-1.03)	0.090
Not Indicated	1.18 (0.85-1.64)	0.313	1.68 (1.29-2.19)	<0.001
Baseline core regimen				
TDF Based	Reference		Reference	
ABC Based	0.77 (0.54-1.09)	0.142	0.91 (0.61-1.37)	0.657
AZT Based	1.13 (0.95-1.35)	0.163	0.86 (0.67-1.09)	0.207
D4T Based	1.31 (1.08-1.59)	0.005	1.17 (0.93-1.49)	0.180
Other	1.04 (0.84-1.30)	0.708	0.93 (0.73-1.20)	0.599
Current core regimen				
TDF Based	Reference		Reference	
ABC Based	0.94 (0.70-1.27)	0.700	2.84 (2.18-3.69)	<0.001
AZT Based	0.72 (0.58-0.88)	0.002	1.30 (1.02-1.66)	0.037
Other	2.19 (1.69-2.83)	<0.001	1.24 (0.90-1.73)	0.192
Baseline Viral Load				
<1000 copies/ml	Reference		Reference	
>=1000 copies/ml	2.52 (2.09-3.03)	<0.001	1.51 (1.20-1.90)	<0.001
Not done	5.84 (4.75-7.19)	<0.001	0.47 (0.28-0.78)	0.003
Last Viral Load				
<1000 copies/ml	Reference		Reference	
>=1000 copies/ml	4.38 (3.58-5.36)	<0.001	2.47 (1.98-3.08)	<0.001
Not done	6.79 (5.44-8.47)	<0.001	5.73 (3.48-9.44)	<0.001
Comorbidity/ Chronic Illness				
No	Reference		Reference	
Unknown	9.60 (7.15-12.88)	<0.001	6.20 (4.22-9.09)	<0.001
Yes	2.94 (1.27-6.78)	0.012	2.60 (1.13-5.97)	0.025

The cumulative incidence plot, figure 11, shows the cumulative incidence of mortality over time on ART.

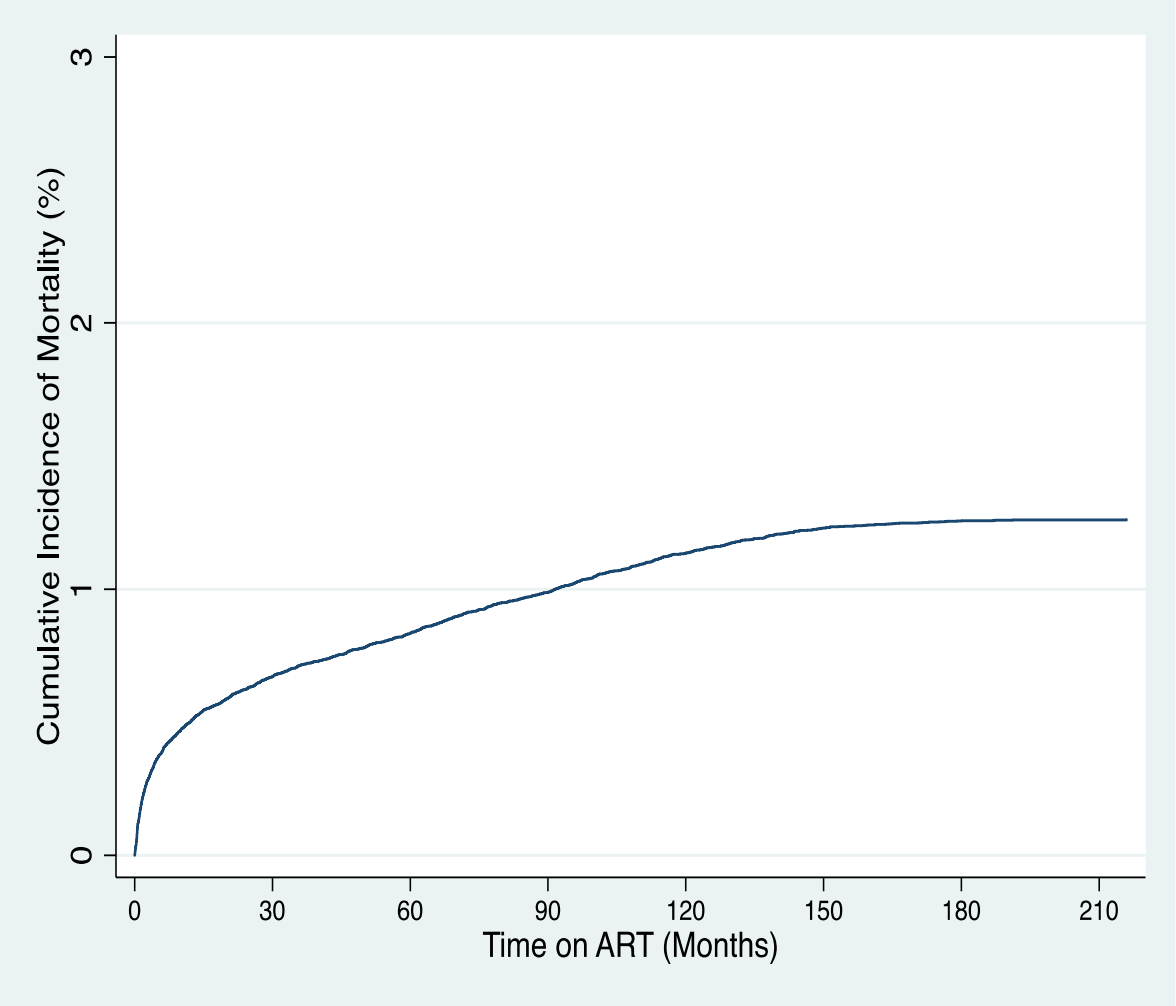

Figure 11: Cumulative incidence of mortality over time on ART, October 2016 to March 2021.

The cumulative incidence plot, figure 12, shows there was a higher cumulative incidence of mortality over time for those who had baseline and last viral loads non-suppressed (>=1000 copies).

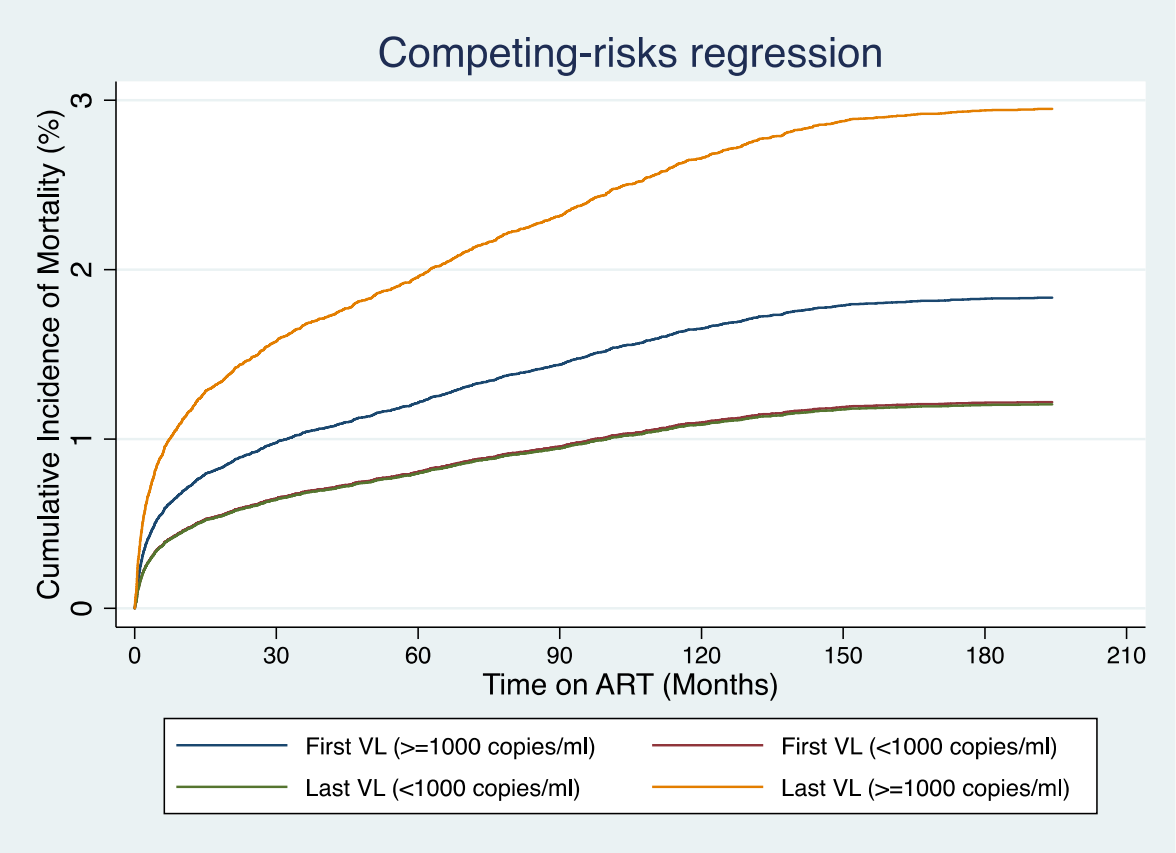

Figure 12: Cumulative incidence of mortality over time on ART by baseline and last viral suppression status, October 2016 to March 2021

INTERPRETATION OF FINDINGS

The following were the key findings:

1. HIV TESTING SERVICES

The peak of HIV testing and identification from quarter 4 of 2017 to quarter 2 of 2018 coincided with the HTS surge in the three Naishi counties when additional resources were availed to recruit and deploy additional HIV testing counsellors. In addition, the additional investment came at a time when the project had adequate amounts of HIV test kits that enabled mass testing in various departments especially in the OPD. The decline thereafter was as a result of withdrawal of the additional resources and investments for the HTS surge and introduction of the HTS optimization initiative which focused on strategies such as HTS eligibility screening in OPD to identify and test those at significant HIV risk, assisted partner notification services, family testing, testing in TB and those malnourished. This new identification strategy was opportune at the time the project, and the country at large, which experienced a reduction in key resources for mass testing such as HIV rapid test kits and HTS

providers. The same overall trend was noted in the HIV positive identification and linkage, showing a proportionate contribution of testing to identification of positive individuals in the region. However, there were some quarters with increased testing coverage the percentage of HIV positive clients identified declined.

The HTS positive clients identified in the IPD vary by the nature of hospital admissions at any given time. There were confounding factors that affected HIV testing during the period such as industrial action of health workers and Covid-19 epidemic which reduced health facility workload in and ultimately HIV testing services in some period of the project. The institutionalization of eligibility screening at facility entry points in the outpatient departments also saw increasingly less numbers of clients receiving an initial HIV test in the IPD thus leading to less numbers identified in that department.

The majority of newly identified clients were linked to the CCC within the same facility of identification and initiated on ART. The ART initiation numbers shot up in 2017 with a peak in 2018 given introduction of test and start in 2016, with subsequent highs and lows in numbers. A few clients were reported as not linked due to various reasons such as: some clients declining treatment, clients with presumptive TB or those diagnosed with TB and cryptococcal meningitis, some clients requesting to be linked to other facilities that did not necessarily report care and treatment data to CHS Naishi. Other clients died before initiation. Those that were initially clinically ineligible for linkage to ART were linked in subsequent periods, while those declining were followed up through tracing and counselling sessions and a majority eventually linked.

The majority of clients on ART were females and adults above 25 years. There were notable ART regimen changes from TDF to TLD and phase out of AZT/D4T backbone. Targeted strategies need to be put in place to improve identification and linkage of these target groups.

2. ANTIRETROVIRAL THERAPY TREATMENT OUTCOMES

Viral Load Suppression

The majority of clients on ART were females and adults. Most of the clients were at HIV WHO stage 1 at baseline, an indication that they were identified with HIV at an early stage. Over half were

on TDF at baseline and as the current core regimen. Most clients were virally suppressed and very few had a documented comorbidity or chronic illness due to high viral load suppression and adherence to medication.

The majority of clients are on TDF as the current core regimen and majority of them are virally suppressed. Characteristics associated with viral load suppression were: being female, adults above 35 years, married, HIV WHO stage 1& 2 at baseline, and TDF current core regimen. A higher proportion of current non-suppressed clients were non-suppressed at the beginning of program implementation. The proportion of clients who are virally suppressed increased over time with increased routine use of viral load as the mainstay for ART monitoring.

Characteristics associated with viral non-suppression were being male sex, age categories 0-34, never married or with unknown marital status, underweight, WHO stage 3, 4 or un-staged, ABC, AZT as core baseline and current regimens, and those on ART for 7-12 months.

Several factors may explain the results presented in this report. Factors such as drug susceptibility, clients pharmacokinetics and virus characteristics determine whether viral suppression is achieved or not. However, the main factor determining viral suppression remains adherence to medication. Clients who had strong social support systems and achieved disclosure were more likely to suppress faster and sustain suppression. This may explain why females and married clients had better suppression rates. Food insecurity and subsequently underweight clients also affects adherence whereby clients feel they are unable to take their medication before they have had a meal.

Strategies such as ART optimization saw eligible clients being switched to newer drugs such as TDF and Dolutegravir (DTG) which are associated with faster achievement of viral suppression as well as sustained suppression due to their higher genetic barrier.

Lost to Follow-up

Age categories aged 10-14, 15-19, 45-54, and 55-64 years were significantly associated with a higher risk of being LTFU. The age 10-19 age band category are school going children in both day and boarding schools. The highly structured school system with a specific calendar of activities and school

breaks are not flexible to enable children and adolescents living with HIV to attend their clinic appointments.

Learners living with HIV may be stigmatized due to repeated absenteeism from class to attend clinic appointments because they have not disclosed their status to the school administration. Further lack of privacy to store and take medication, psychosocial support from teachers and peers may affect the learners' adherence and retention in care. This raises a major concern to the parents and the children which would lead to them dropping out of care. Disclosure of the HIV status to the child may also lead to them missing their appointment due to post disclosure stress if not well handled and more so if the disclosure is done late.

Early disclosure by the age of 10 years has been shown to improve self-esteem with less cases of depression. Younger children who depend on caregivers to bring them to the facility may occasionally miss their clinical appointment which is dependent on the availability of their caregiver. Additionally, children with multiple caregivers who may not be aware of the child's HIV status often miss their clinical appointments and medication while others are moved from one household to another thus interrupting their care.

The older clients (45 – 64 years) have shown a higher risk for lost to follow-up. Lower eastern region is predominantly a rural setting where many of the elder members of the community are peasant farmers while others solely dependent on their adult children who have moved to urban areas for work to send money home to support them. In some cases, the children are unable to meet the financial needs of their elderly parents and this has resulted in this age group falling out of treatment. Some of these elderly parents have not disclosed their HIV status to their children for fear of blame, a sense of shame and fear of being isolated by their family and this has also contributed to them missing clinic appointments.

Like other studies conducted, men have been shown to have a higher risk of LTFU than women. This is majorly attributed to the gender norms and societal expectations where men are the heads of households and breadwinners. The choice between seeking health services and provision of food for their families creates a barrier to access of ART. Further, movement from one region to another seeking casual labor and employment makes them less likely to access care and treatment services. The separated or divorced clients as well as those in polygamous type marriages were shown to default

care. This is attributed to movement from their matrimonial homes following separation, socio-economic instability, discrimination especially if there is discordancy and poor psychosocial support.

Those with advanced disease in WHO Stage III and with a higher viral load of above 1000 were highly likely to be associated with LTFU. This was caused by hospitalization of some of the clients, late diagnosis that led to poor prognosis and eventual death. Missed appointments and poor drug adherence would lead to immune injury with subsequent opportunistic infections that made the clients weak and eventual drop off from care. This would be seen in their baseline or routine viral load.

Mortality

The characteristics associated with higher risk of mortality among HIV positive clients were being male, ages 55 to 64 and 65 years, those not married or in polygamous relationships, those with un-staged HIV WHO, stage 3 and stage 4, underweight BMI, non-suppressed or unknown viral suppression status at both baseline and currently compared to those who were suppressed; and other current core based regimen compared to TDF based core regimen. Mortality over time plateaus since the program began early initiation of ART interventions and clients experiencing high levels of viral suppression.

CONCLUSION

OPD contributed to the highest proportion of HIV tests done and positives identified. The HTS surge in project two had a demonstrable yield in both number tested and number tested HIV positive. Consistent HTS eligibility screening to identify those at significant risk of HIV infection together with index case testing strategies contributed to an improvement of the number needed to test one positive and overall HIV positivity yield. Covid 19 epidemic and health care workers industrial action had a negative effect on HIV testing services in various project periods. Same day and same facility initiation of ART to the newly identified clients contributed to a relatively high linkage of 92%.

There are strategies that worked towards improving the project's treatment growth and viral suppression. These are: continuous client education on adherence and appointment keeping, weekly

facility level review of client attrition, improved appointment management and reporting through use of EMR system, and improved documentation of defaulter tracing activities and outcomes.

COVID-19 had a negative effect on care and treatment where facilities experienced reduced patient clinic attendance due to lock downs, economic downtimes, closure of hospital departments when health care workers were infected by COVID-19, and fear of infection with COVID-19 among clients.

Stock outs of HTS testing kits, ART, and viral load testing commodities led to slow down of these activities in 2021. This includes the suspension of VL sample collection and testing due to commodity stock outs and plasma preparation tubes for sample collection and testing reagents. In addition, there was an unstable supply of ARV drug commodities like tracer drug Tenofovir, Lamivudine, and Dolutegravir (TLD) and Lopinavir (LPV/r) Pellets, DTG 50mg and ABC 300mg tablets. This project was able to mitigate the effects of the shortages by doing close monitoring of commodity supplies in the facilities and proactive tracking and rotation of commodities within the health facilities in the region.

Key Considerations

1. OPD HTS optimization through HTS eligibility screening to achieve testing efficiency.
2. Continue to target high yielding HTS strategies like aPNS to increase the elicitation ratio, high identification of positives through index testing.
3. Conducting CQI project for children identification could increase the number of HIV positive children identified.
4. Periodic performance tracking using mobile technology to ensure close monitoring of HIV testing, identification positives, and ART initiation.
5. Periodic data review per county, facility, and even individual HTS counselors to monitor progress against time and institute immediate remedial actions on gaps identified.
6. One on one mentorship with HTS counselors through role plays to improve quality of HTS eligibility screening and elicitation.
7. Optimized rescreening among newly enrolled, HVL, PMTCT and adolescent and young people to identify sexual contacts for testing.

8. Implementation of strategies to reach men for HIV testing and linkage to ART through distribution of HIV self-test kits to men, employing the Social Network Strategy to reach friends of men who test HIV positive in the facilities, and engaging antenatal care mothers to bring partners for testing.
9. Same day initiation of ART to the newly identified to improve linkage.
10. Engagement with the Counties on continuous provision of PPEs to the HTS counsellors.
11. Capacity building of HTS counsellors on importance of wearing PPEs and maintaining social distancing to avoid interruption of services.
12. Proper utilization of eHTS to provide real time data for HTS and institution of immediate action plans.
13. Improve appointment management and reporting through use of EMR system.
14. Engagement of KENAPOTE (Teachers living with HIV) to support learners with HIV.
15. Collaborate with OVC partner to trace LTFU children and adolescents.
16. Integration of HIV, TB and COVID screening to avoid missed opportunities
17. Profiling clients by age, socioeconomic status and level of social support to help offer appropriate retention support e.g. spacing of facility visit appointments
18. Offer newer ART regimens for sustained viral suppression.

Lessons Learnt

1. OPD HTS eligibility screening contributes significantly in HTS efficiency.
2. Optimization of safe and ethical index testing has significantly contributed to positive identification.
3. Adequate counselling before and after HIV testing and counselling helps to address stigma and fear associated with HIV diagnosis.
4. Weekly performance tracking is key in monitoring performance of key indicators per facility and enables speedy feedback on recommendations for gaps identified.
5. One on one mentorship with HTS counselors, clinical officers, nurses, and health records officers through role plays to improve on quality of patient care and documentation helped to improve all aspects of the program.
6. Optimized rescreening among newly enrolled, HVL, PMTCT and adolescent and young people has enabled identification of sexual contacts for HIV testing.

7. Active engagement of CHMT/SCHMT/facility in charges on importance of targeted HTS testing, quality of patient, and documentation improves ownership of HIV programming
8. Flexi/extended hours clinics offer clients extra time to access clinic where they were unable to attend during official working hours, thus improving retention.
9. Implementation of same day initiation increases the linkage of clients who are newly identified and is effective when done before an official transfer out to another facility. The use of the national health facility directory enables complete referrals to other facilities.
10. Structured treatment literacy classes improve client's knowledge about HIV and self-care and is a strategy to improve retention and better patient outcomes.
11. Client follow-up through phone calls and physical tracing enables tracking and increases the number of clients returning to care.
12. Documenting clients phone contacts and physical address for easy follow-up
13. Timely investigation for the TB presumptive client and timely ART initiation for those diagnosed with TB.
14. Weekly tracking of unlinked positives and institution of site/officer specific remedial actions.
15. The project was able to reduce missed appointments through implementing patient centered multi month dispensing, initiating community & facility ART groups, facility level audits of client attrition with targeted interventions, appointment reminders using T4A, targeted physical tracing of LTFU clients, and collaboration with OVC partners for defaulter tracing of children and adolescents missing appointments.
16. Some strategies implemented to improve uptake and viral suppression among children and adolescents such as DOTs for viraemic children, NimeCONFIRM, audio and physical DOTS, enhanced adherence counselling for caregivers and unstable clients in PAMA and OTZ.
17. To improve retention among children and adolescents, the engagement of PAMA and AYP champions for immediate tracing of children and adolescents living with HIV who miss appointments, realignment of clinic appointments with school calendar, and collaboration with OVC partner to trace LTFU children and adolescents yielded positive results.
18. There is room for early and improved TB diagnosis among clients in care.
19. There is minimal documentation of other chronic illnesses and co-morbidities among clients in care which may lead to insufficient information necessary for client monitoring.

DISSEMINATION OF FINDINGS

Evaluation findings will be disseminated to all key stakeholders including the CHMTs, NASCOP, NTLD-Program, the MOH, CDC, and the public through dissemination meetings or scientific forums. In addition, selected findings will be disseminated through publications in peer-reviewed, open-source journals. Finally, CHS will publish the findings in internal newsletters and organizational websites for access by the public. All stakeholders will be involved in the dissemination of the evaluations results at different levels. The evaluations report will be presented to CDC as part of its reporting requirements. The final evaluation report is in alignment with the PEPFAR Evaluation Standards of Practice requirements and posted (in English) on a publicly-accessible website within 90 days of report clearance. Only de-identified individual patient-level data will be released according to the CDC data policy on a limited release approved by CDC, CHS program, and data team. A reasonable request for the individual patient-level data can be made to the Chief Executive Officer through the email address; info@chskenya.org. All the other aggregate data used was under general release to the public.

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APPENDIX

1A Matrix with the evaluation design details

No.	Objectives	Indicator	Data source	Data Source Type
1	Objective 1 and 2:	**HIV testing coverage**: Number of eligible clients tested for HIV in Out-patient department (OPD) and in-patient department (IPD)	MOH 362 HTS register MOH 731 Monthly report summary HTS eligibility screening tool Point of service testing reports Family and partner testing register	Both paper and electronic
2	Objective 1 and 2:	**Patient characteristics and ART treatment outcomes**: Proportion of PLWHIV initiated on ART Proportion of clients achieving viral suppression Proportion of clients accessing viral load testing in a timely manner Proportion of clients with treatment failure **Variables:** Age, Gender, Marital Status, Height/Weight, TB status, Initial HIV Status, Baseline and follow-up Viral Load, Enrolment into care, and Retention outcomes (Death, LTFU, Transfer Out, Retained), If on HAART, Follow-up Viral Load.	Treatment preparation register, ART register, Cohort analysis registers, Viral load register, Electronic medical records, Mortality audit minutes, defaulter tracking registers, MOH 257 (HIV Care Patient Card)	Both paper and electronic

1B Data Sources and documents list

1. Adults ICF/IPT card
2. Antenatal Clinic Register
3. Appointment Diary
4. ART Cohort Register
5. CCC Defaulter tracing Register
6. Clinical Encounter Record- Oral PrEP
7. ART Cohort Register
8. Community Linkage Register
9. EMR_Systems list
10. Daily Activity Register for CCC
11. DAR for ARV's and OIs
12. DC- ART refill Diary
13. DC-ART distribution form
14. Electronic ARV dispensing tool (ADT)
15. Family and Partner Testing Tracking Register
16. FCDRR for ARV/OI drugs
17. HIV Testing and Counseling Register
18. IQ Care-Electronic medical records
19. Linkage register
20. MOH 731 Monthly Report Summary
21. Presumptive TB register
22. TB active case-finding/screening tool
23. TB Contact Invitation register
24. TB patient card
25. TB4 register-TB Treatment Unit Register
26. Treatment preparation (Pre-ART) register
27. Viral load register
28. Out-Patient Department Register
29. In-Patient Department Register

BUDGET

The budget was as follows:

Budget line	Amount (USD)
Pre-survey budget	12,505
Personnel	49,100
Coordination	22,522
Supplies	5,857
Post-survey budget	25,020
Total	**115,004**