

# Viral Load suppression after intensive adherence counselling among HIV infected adults at Kiswa Health Centre, Kampala: A retrospective cohort study. Secondary data analysis

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## Research Article

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## Abstract

# Background

The Joint United Nations Programme on HIV/AIDS through the 95-95-95 target requires 95% of people with HIV infection (PWHIV) on antiretroviral treatment (ART) to be virally suppressed. Viral Load (VL) non-suppression has been found to be associated with suboptimal ART adherence, and Intensive Adherence Counselling (IAC) has been shown to lead to VL re-suppression by over 70% in PWHIV on ART. Currently, there is data paucity on VL suppression after IAC in adult PWHIV in Uganda. This study aimed to evaluate the proportion of VL suppression after IAC and associated factors among adult PWHIV on ART at Kiswa Health Centre in Kampala, Uganda.

## Methods

Study was a retrospective cohort design and employed secondary data analysis to review routine program data. Medical records of adult PWHIV on ART for at least six months with VL non-suppression from January 2018 to June 2020 at Kiswa HIV clinic were examined in May 2021. Descriptive statistics were applied to determine sample characteristics and study outcome proportions. Multivariable modified Poisson regression analysis was employed to assess predictors of VL suppression after IAC.

## Results

Analysis included 323 study participants of whom 204 (63.2%) were female, 137 (42.4%) were between the age of 30 and 39 years; and median age was 35 years (interquartile range [IQR] 29–42). Participant linkage to IAC was 100%. 48.6% (157/323) of participants received first IAC session within 30 days or less after unsuppressed VL result. 66.78% (205/307) of participants who received recommended three or more IAC sessions achieved VL suppression. 34% of participants completed three IAC sessions in recommended 12 weeks. Receipt of three IAC sessions (ARR = 1.33, 95%CI: 1.16–1.53,  $p < 0.001$ ) and having baseline VL of 1,000–4,999 copies/ml (ARR = 1.47, 95%CI: 1.26–1.73,  $p < 0.001$ ) was significantly associated with VL suppression after IAC.

## Conclusion

VL suppression proportion of 66.78% after IAC in this population was comparable to 70%, the percentage over which adherence interventions have been shown to cause VL re-suppression. However, timely IAC intervention is needed from receipt of unsuppressed VL results to IAC process completion. Resistance testing should be performed for PWHIV with persistent VL non-suppression after IAC for apt ART regimen switch.

## Introduction

According to UNAIDS, 95% of PWHIV on ART should be virally suppressed as was ambitiously set through United Nations' 95-95-95 target [1], fast tracking the sustainable development goal to end the HIV epidemic by 2030 [2, 3]. In 2020, out of 37.7 million PWHIV globally, 73% had access to ART and 66% had achieved viral suppression [4]. In Uganda by 2020, out of the 1.4 million PWHIV, 91% knew their HIV status, 90% were on ART and 82% had viral suppression [5]. In order to achieve benefits of early ART initiation, PWHIV on ART must be virologically suppressed [6, 7], which hinges on effective behavior change interventions by HIV care providers, health sector leadership and PWHIV themselves to facilitate good adherence to ART [8]. Good ART adherence defines as properly following treatment provider recommendations regarding ART dosage, frequency and timing of swallowing medication [9]. Poor ART adherence is a major cause of treatment failure in PWHIV [10–14] and ensuring sustained adherence to ART can achieve viral suppression except for presence of HIV drug resistance [15–20]. If an HIV infected person is not virally suppressed, they will have slow immune system recovery, HIV disease advancement, increased morbidity and an enhanced HIV infection transmission risk [2, 21–24]. ART-associated side effects, younger age, substance use, depression and forgetting dosing time are linked to sub-optimal ART adherence [14, 25]. Additionally, individual ART initiation incentive, education level, duration on ART, stigmatization and HIV status disclosure affect ART adherence [19, 25, 26].

IAC assists individuals to develop a comprehensive ART adherence strategy by identifying and gaining insight of adherence barriers, explore practical ways to overcome the barriers and generate an ART adherence plan [13, 18].

WHO endorses IAC provision for both children and adults who are found to have an unsuppressed VL, which adherence support has been shown to improve the VL suppression by up to 70% [17, 18]. HIV VL suppression achieved through IAC ensures extended preservation of first-line ART regimens and reduces HIV resistant strains in novel infections [12]. PWHIV at increased likelihood of suboptimal or non-adherence to ART profit from focused adherence interventions that are contextual, socially acceptable and hinged on principles of human reason and behavioral values [27, 28]. A multidisciplinary team of counselors, clinicians, nurses and peers provides IAC to clients using the 5 As counseling framework of Assess, Advise, Assist, Agree on and Arrange [13, 18]. The Uganda Ministry of Health guidelines state that PWHIV on ART with un-suppressed VL should receive IAC, one counseling session monthly for three months, followed by repeat VL measurement a month after the third IAC session [13]. Virally suppressed individuals on repeat VL testing continue with the same ART regimens while those with unsuppressed VL are considered for a switch to the next line ART regimens [13]. Effective and timely IAC intervention is necessary for individuals with unsuppressed VL to achieve viral suppression and maximally benefit from ART [17]. Delayed confirmation of unsuppressed VL and late linkage of individuals with unsuppressed VL to the IAC intervention contribute to late detection of ART failure [12]. A need to re-evaluate the IAC intervention implementation among virally non-suppressed PWHIV on ART has already been documented for Uganda [16, 29]. Necessity to improve the delivery of IAC with component structuring, context and information packaging has been expressed as well [30].

Although Uganda has employed the IAC intervention program since 2015, scanty research data is available on HIV viral suppression after IAC. Central Uganda has higher HIV prevalence compared to other regions of the country; and urban areas have an even greater HIV burden than rural areas with urban areas HIV prevalence being 7.5% in comparison to 5.8% in rural areas [31]. There is paucity of data on proportions of HIV VL suppression after IAC and its predictors for adult PWHIV with unsuppressed VL in an urban setting in Uganda, which data is beneficial in critical appraisal of IAC implementation in Kampala, an overly populated urban center with a viral suppression prevalence of only 62.1% [31].

This study aimed to evaluate the proportion of VL suppression after IAC and associated factors among adult PWHIV on ART at Kiswa Health Centre in Kampala, Uganda.

## Materials And Methods

### Study design and Setting

A retrospective cohort study design that employed approaches of secondary data analysis of routinely available program data on HIV-infected patients receiving ART at Kiswa Health Centre, a public HIV clinic in Kampala district was used. The proportion of PWHIV with VL greater or equal to ( $\geq$ ) 1000 copies/ml, on a test done between January 2018 and June 2020, who achieved VL suppression following IAC was determined; as well as the time to completion of the IAC sessions and the factors that were associated with VL suppression after IAC.

The study was conducted in Kampala district at an HIV Clinic in Kiswa Health Centre situated within Nakawa Division. Located in the central region, Kampala, the capital city of Uganda is the second most populated district in Uganda with a population size of 1,507,080 people, 51.9% being females [32]. Kampala is 100% urban and remains the most populated urban center in Uganda [32].

According to a Uganda national survey conducted between August 2016 and March 2017, Kampala capital city had an HIV prevalence of 6.9% amongst people aged 15 to 64 years [31]. Kiswa Health Centre was carefully selected because of its urban location and easy accessibility as one of the HIV clinics under KCCA within Kampala district.

### Population and Procedures

The study population was all HIV infected persons aged 18 years or older, who had been on ART for at least six months with VL  $\geq$  1000 copies/ml, on a test done between January 2018 and June 2020. Data collection was completed in four weeks in May 2021.

Anonymized client information was used for secondary analysis and each study participant received a unique identifier. Data on key variables of interest including age in years, sex, level of education, occupation, religion, marital status, WHO clinical stage for HIV infection, ART regimen at time of VL non-suppression, ART regimen initiation date, CD4 cell count at time of VL non-suppression, non-suppressed VL test result at beginning of IAC, number of IAC sessions received, dates IAC sessions were received and repeat VL test result following IAC was abstracted from the HIV clinic source records and captured into a Microsoft® Excel database. The primary sources of data were the HIV clinic's health management information system, ART registers, VL registers, IAC registers and client treatment files/cards. Data was thoroughly reviewed to ensure quality.

### Laboratory methods

VL testing is performed after 6 months following ART initiation and every 6 months for those that have HIV VL suppression. VL testing is done at the Central Public Health Laboratories and VL test results received from the national laboratory are recorded in VL registers and client cards by health facility staff and given to the clients at subsequent clinic visits.

### Statistical Analysis

The primary study outcome was VL suppression after IAC. VL suppression was defined as a VL result of less than 1000 copies/ml [13, 18]. A VL test result equal to or greater than 1000 copies/ml was termed as VL non-suppression. The time to first IAC session was defined as the time difference between the date of the baseline non-suppressed VL test result and date of first IAC session. Data was exported to Stata version 14 computer software package for analysis. The proportions of study participants with VL  $\geq$  1000 copies/ml who received IAC and individuals who achieved VL suppression following the IAC intervention were determined. Additionally, the time taken to completion of the IAC sessions was described, as well as the factors associated with VL suppression after IAC in the study population. Descriptive statistical analysis was performed for the socio-demographic and clinical characteristics of the study participants using means and frequencies. Bi-variable analysis was used to analyze the relationship between each independent variable and the primary outcome.

The Chi-Square test was used to assess association strength between the variables and the outcome, and p-values of less than 0.05 were considered statistically significant [33, 34]. All variables in the bivariable analysis that had a p-value  $<$  0.05 for association with VL suppression after IAC were included in the multivariable modified Poisson regression analysis to assess independent relationships further while adjusting for potential confounders [33–35]. P-values  $\leq$  0.05 were considered statistically significant. Time to completion of the IAC sessions was expressed by the Kaplan–Meier survival curve [34, 36].

### Ethics statement

Local ethical approval was provided by Mildmay Uganda Research Ethics Committee (1012–2020). Study administrative clearance was received from Kampala Capital City Authority and the In-Charge of Kiswa Health Centre III. The raw data will be retained for five years. Anonymized data and lack of access to participant files offered protection from risk of confidentiality breach.

## Results

A total of 410 HIV infected adults at Kiswa Health Centre with an unsuppressed viral load  $\geq 1000$  copies/ml in the period from January 2018 to June 2020 were eligible for enrollment into the study. 323 (79%) of the eligible study participants were included in analysis as 87 (21%) individuals were either lost to follow, transferred out, dead or had missing information and these were not included in analysis.

## Baseline characteristics of study participants

Out of the 323 participants, 204 (63.2%) were female. The majority of study participants; 137 (42.4%) were between the age of 30 and 39 years. The median age was 35 years (IQR: 29–42). Most participants (65.3%) were from Kampala district. The median time duration on ART at the time that the participant had a detectable VL was 4 years (IQR: 1–7), with the shortest time on ART being 6 months while the longest duration on ART was 16 years. Majority of the study participants were on an Efavirenz (EFV) based ART regimen; 143 (44.3%), in WHO clinical stage 1; 253/266 (95.1%) and had been on ART for more than 5 years at time of VL detection; 153 (47.8%).

## IAC: Number of sessions received and process completion timelines

All 323 study participants received at least one IAC session following the baseline unsuppressed VL result. The majority of participants; 208 (64.4%) received more than three IAC sessions. 99 (30.7%) participants received three IAC sessions. 16 participants had one or two IAC sessions.

Only 39.1% of study participants completed the IAC intervention in 12 weeks or less while the majority of participants (46.7%) completed IAC between 13 and 24 weeks. 12 weeks is the recommended time duration within which the three standard IAC sessions should be completed as per the Ministry of Health guidelines [13]. For this analysis, only study participants who received the recommended three IAC sessions or more (304) were included as these were considered to have completed the IAC intervention. Out of 323 participants, 16 had either one (7) or two (9) IAC sessions and three participants had missing IAC dates for the sessions recorded and hence these were excluded from the analysis. At 12 weeks (3 months), 34% of the participants had completed IAC, 58% had completed IAC at 16 weeks (4 months), 83% had completed at 24 weeks (6 months) and the remaining 17% completed IAC in more than six months.

## VL suppression after IAC and associated factors

Out of the 323 study participants with baseline viral non-suppression, 216 (67%) achieved VL suppression after the intensive adherence counseling intervention regardless of the number of sessions received. (95% CI: 62%-72%). At bivariable analysis, participants who received three IAC sessions had a higher proportion of viral suppression after IAC (79.8%) than those who had received more than three IAC sessions (60.6%),  $p < 0.001$ . Males had a higher proportion of VL suppression (72.3%) in comparison to the females (63.7%),  $p = 0.105$ . More so, the clients who had a baseline VL test result of 1,000–4,999 copies/ml had a higher proportion of viral suppression (81.8%) compared to participants whose baseline VL test result was 10,000 copies/ml or higher (53.6%),  $p < 0.001$ . Additionally, the participants on a Dolutegravir (DTG) based ART regimen at the time of VL non-suppression had a higher proportion of viral suppression (95.3%) compared to those on an EFV based regimen (58.7%),  $p < 0.001$ . At multivariable analysis, study participants who received three IAC sessions were 33% more likely to have VL suppression than those who received more than 3 IAC sessions (4, 5 or 6 sessions), ARR: 1.33 (1.16–1.53),  $p < 0.001$ . Similarly, participants who had baseline VL of 1,000–4,999 copies/ml were 47% more likely to suppress compared to those with VL  $\geq 10,000$  copies/ml, ARR: 1.47(1.26–1.73),  $p < 0.001$ . Lastly, participants on DTG and ATV/r based ART regimens were 55% and 29% more likely to suppress when compared to those on EFV based ART regimen, ARR: 1.55 (1.33–1.80),  $p < 0.001$  and ARR: 1.29 (1.03–1.60),  $p = 0.025$  respectively.

## Discussion

In this retrospective cohort study, the HIV VL suppression proportion was 67% following IAC intervention for HIV infected adults at Kiswa Health Centre, who had been on ART for at least six months and had an unsuppressed VL in the period from January 2018 and June 2020. Linkage to IAC following the baseline unsuppressed VL was 100% in the study population. 48.6% of study participants were linked to the IAC intervention in less than a month from the time of the non-suppressed VL result. 95% of study participants received three or more IAC sessions. Majority of participants (46.7%) completed IAC between 13 and 24 weeks and only 34% completed the IAC intervention in the recommended 12 weeks.

A retrospective cohort study in rural Uganda in 2017 found that 19% of 411 PWHIV with an unsuppressed VL did not receive IAC [37] while another earlier retrospective review conducted at 15 Uganda public health centers from June 2015 to December 2016 found that 7% of 449 study participants with VL above 1000 copies/ml did not have any IAC session provided [16]. This improvement in IAC linkage reflects the increased efforts by Ministry of Health in Uganda which is geared towards increased routine HIV VL testing to quickly refer for the IAC intervention all PWHIV identified to have unsuppressed VL [13].

The study results on IAC linkage are comparable to findings from Ethiopia where all 235 PWHIV with unsuppressed VL involved in the retrospective cohort study received IAC [12], and findings from South Africa where all 400 eligible participants received IAC in a prospective cohort study [20]. IAC linkage in our study is 24.3% higher than the findings from a retrospective cohort study in Zimbabwe where out of 646 participants with unsuppressed VL, 75.7% were enrolled into IAC [14].

In this study cohort, 77.4% of study participants received the first IAC session within 60 days or less from the time of the baseline non-suppressed VL result. This is an improvement by approximately 20 weeks in the aptness of IAC intervention provision in a public health facility setting when compared to earlier findings where the first IAC session was received up to 200 days following the unsuppressed VL result availability by 75% of study participants [16]. However, the recommended time to first IAC session is 30 days as per Uganda national guidelines [13]. Enhanced adherence counseling (EAC) is more timely in Ethiopia as 8 weeks is the median time to the first counselling session [12].

Only 34% of participants completed the recommended three IAC sessions in 12 weeks in the study, a proportion 12.8% smaller than the proportion of study participants who completed IAC in the recommended three months in a retrospective cohort study in Ethiopia [12].

75% of study participants had completed the IAC intervention in 20 weeks, which was an improvement by 30 weeks in comparison to the findings of the same percentage (75%) of participants who finished the three IAC sessions after 50 weeks in an earlier retrospective cohort study conducted in Uganda [16].

66.78%, the VL suppression proportion for all participants who received the recommended three or more IAC sessions is 58% more than the VL suppression percentage after IAC documented by a prospective cohort study [29] and 44% higher than the VL suppression proportion documented by a retrospective research [16], which studies were both conducted in public HIV health care settings in Uganda. This VL suppression proportion of 66.78% is comparable to 70%, a percentage above which adherence support has been found to enhance VL suppression in PWHIV with a previously unsuppressed VL [17, 18]. In addition, 66.78% is comparable to: 66.4%, the VL suppression proportion after IAC for Ethiopia [12] and 67.5% [38] as well as 64% [20], the VL suppression proportions after IAC documented for South Africa. The VL suppression proportion of 66.78% found in our study is also comparable to 67%, the VL suppression proportion after IAC for Burkina Faso, Côte d'Ivoire, Senegal and Mali [39]. However, 66.78% is way higher than the VL suppression percentage stated in Zimbabwe following EAC [14] and the VL suppression of 10% found in a prospective cohort study in Tanzania following reinforced adherence counseling [40]. All study participants who achieved viral re-suppression after IAC did not require ART regimen switch which inherently helped in the preservation of the next line ART medications for when their need is warranted; a very core aim of the IAC intervention.

The study findings are contrary to those in a Swaziland study where EAC did not increase the likelihood of VL suppression [41].

Bivariable analysis showed an association between VL suppression after IAC and number of IAC sessions received, baseline non-suppressed VL result and ART regimen. Multivariable modified Poisson regression analysis findings demonstrated significant associations between VL suppression after IAC and number of IAC sessions received, baseline non-suppressed VL result and ART regimen type. The participants who received three IAC sessions were 33% more likely to have VL suppression than those who received more than 3 IAC sessions (4, 5 or 6 sessions), (ARR: 1.33, 95% CI: 1.16–1.53,  $p < 0.001$ ). On the contrary, number of intensified adherence counseling sessions received was found not to be independently associated with VL suppression in a retrospective cohort study in Zimbabwe [14]. However in this Zimbabwean study, the participants who received three IAC sessions were more likely to virally suppress after IAC (68%) when they were compared to those that did not receive any enhanced adherence counseling session [14].

Study findings support the current Uganda national guidelines that the recommended three IAC sessions are potent and by a larger proportion, in reversing HIV viral non-suppression among PWHIV who have been on ART for at least six months [13], as it is mostly challenges with good adherence to ART that lead to VL non-suppression [10–14].

The study participants whose VL was in the range 1,000–4,999 copies/ml were 47% more likely to suppress after IAC compared to their counterparts with VL  $\geq 10,000$  copies/ml (ARR: 1.47, 95% CI: 1.26–1.73,  $p < 0.001$ ). Additionally, the probability of VL suppression was 19% higher for study participants whose VL was between 50,000–10,000 copies/ml in comparison to those whose VL  $\geq 10,000$  copies/ml (ARR = 1.19, 95% CI: 0.86–1.66). The study results are comparable to findings of a retrospective cohort study in Ethiopia where the baseline VL result was an important predictor of VL suppression after IAC [12]. In Ethiopia, the VL suppression probability was 56% lower for study participants with a VL greater than 10,000 copies/ml; and 7% lower for participants whose VL was between 5001–10,000 copies/ml when both categories were compared to those who had a baseline VL of 1,000–5,000 copies/ml [12]. Baseline VL  $\geq 10,000$  copies/ml was also associated with increased odds of VL non-suppression after EAC in Ethiopia from a case-control study [42]. Nevertheless, younger age, extended duration on ART, CD4 cell count of 201 to 500/mm<sup>3</sup> and residing in an urban area are factors found to be positively associated with suppression of VL after EAC in Ethiopia [43]. Similarly, in a retrospective cohort study in Zimbabwe, the participants with a baseline VL greater than 5000 copies/ml had a lower probability of VL suppression after IAC in comparison to those with baseline VL between 1000–5000 copies/ml, with the likelihood of VL suppression reducing with increasing VL test result [14]. The reduced likelihood of viral suppression after the IAC intervention in persons with very high baseline VL results can be linked to possible unidentified accumulated pre-existing resistance to ART and in such individuals, only switching to the next effective ART regimen most accurately determined by resistance testing can reverse the viral non-suppression. Unfortunately, due to cost implications, HIV resistance testing is reserved for limited categories of PWHIV in Uganda including those failing on their second and third line ART regimens [13].

## Study strengths and limitations

Study strengths include the cohort design which inherently provided a temporal causal relationship between IAC and VL suppression [44], a large sample size and utilization of routine patient information collected in a public HIV clinic in an urban setting, thus making the sample representative of the HIV clinic and generalizable to other urban HIV clinics in Kampala and Wakiso districts in Uganda. The major study limitation was utilization of routine clinic data which had missing information and therefore data analysis and interpretation was limited to routinely collected and documented variables in the client records. Important patient variables which could have affected the baseline and repeat VL testing, linkage to IAC and viral suppression post IAC like socio-economic status, education level and distance of patients' residence to the HIV clinic were unavailable. Lastly, since it was an entirely quantitative study, health workers and participants experiences and perceptions regarding the IAC intervention and its delivery were not studied, which could have been examined by qualitative methods.

## Conclusion

In conclusion, client linkage to IAC was 100% and VL suppression after IAC was high and comparable to 70%, a percentage above which adherence support has been found to enhance VL suppression in PWHIV with a previously unsuppressed VL [17, 18]. 48.6% of study participants received their first IAC session within the recommended 30 days or less after the unsuppressed VL result. Only 34% of participants completed the recommended three IAC sessions in 12 weeks as per the Uganda IAC guidelines [13]. Number of IAC sessions received by the participants and baseline non-suppressed VL test results were the factors found to be significantly associated with VL suppression after IAC. Qualitative research to understand perceptions surrounding the IAC intervention is

critical and early resistance testing is recommended for those PWHIV who do not achieve VL suppression after IAC to facilitate timely ART switches to more effective regimens.

## Abbreviations

IAC: Intensified Adherence Counselling, EAC: Enhanced Adherence Counseling, VL: Viral Load, ART: Anti-Retroviral Treatment; HIV: human immunodeficiency virus; WHO: World Health Organization

## Declarations

### Ethical Approval and Consent to Participate

Ethical approval for this retrospective chart review was provided by Mildmay Uganda Research Ethics Committee (1012-2020). Study administrative clearance was received from Kampala Capital City Authority and the In-Charge of Kiswa Health Centre III.

### Consent for publication

Not applicable

### Availability of data and materials

Data used during this study is available upon request from the corresponding author.

### Conflicts of Interest

The authors declare that they have no conflicts of interest

### Authors' contributions

CN designed the study, performed data collection and statistical analyses, and wrote the first draft of the manuscript. NM and DM supported data collection and analysis. RN, HK, HK, GMA, GBB and RCK contributed to study conception and results interpretation. All authors read and approved the final manuscript.

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## Table

Table Participant characteristics and correlates of VL suppression after IAC

Characteristic	Total (%)	Suppressed (%)	Bivariable analysis		Multivariable analysis	
			RR (CI95%)	P value	Adjusted RR (CI95)	P-value
<b>Age in years</b>						
18-29	83(25.7)	59 (71.1%)	1		1	
30-39	137(42.4)	87 (63.5%)	0.89 (0.74-1.08)	0.238	0.9 (0.76-1.07)	0.244
≥ 40	103(31.9)	70 (68%)	0.96 (0.79-1.16)	0.645	0.88 (0.74-1.06)	0.171
<b>Sex</b>						
Female	204 (63.2)	130 (63.7%)	1		1	
Male	119 (36.8)	86 (72.3%)	1.13 (0.97-1.32)	0.105	1.06 (0.92-1.22)	0.453
<b>Participant address</b>						
Kampala	211(65.3)	140 (66.4%)	1			
Wakiso	86(26.6)	58 (67.4%)	1.02 (0.85-1.21)	0.856		
Others	26(8)	18 (69.2%)	1.04 (0.79-1.37)	0.761		
<b>Marital status (n=282)</b>						
Married	143(50.7)	95(66.4)	1			
Unmarried	139(49.3)	94(67.6)	1.02 (0.86-1.20)	0.832		
<b>Treatment line</b>						
First line	271(83.9)	180(66.4)	1			
Second line	52(16.1)	36(69.2)	1.04 (0.85-1.27)	0.685		
<b>WHO clinical stage at time of VL non-suppression</b>						
Stage 1	253(95.1)	173 (68.4%)	1			
Stage 2	6(2.3)	4 (66.7%)	0.97 (0.55-1.73)	0.931		
Stage 3	3(1.1)	1 (33.3%)	0.49 (0.10-2.43)	0.38		
Stage 4	4(1.5)	2 (50%)	0.73 (0.27-1.96)	0.534		
<b>IAC sessions Received</b>						
Yes	323	216 (66.9%)				
<b>Number of IAC sessions provided</b>						
>3 Sessions	208(64.4)	126 (60.6%)	1		1	
3 Sessions	99(30.7)	79 (79.8%)	1.32 (1.14-1.53)	<0.001	1.33 (1.16-1.53)	<0.001
1 or 2 Sessions	16(4.95)	11 (68.8%)	1.13 (0.80-1.61)	0.477	1.05 (0.77-1.43)	0.762
<b>Duration on ART at VL non-suppression</b>						
< 1 year	64(20)	39 (60.9%)	1			
> 1 to 5 years	103(32.2)	66 (64.1%)	1.05 (0.82-1.34)	0.687		
> 5 years	153(47.8)	109 (71.2%)	1.17 (0.94-1.46)	0.166		
<b>Time to IAC linkage</b>						
≤1 month	157(48.6)	106 (67.5%)	1			
>1 month- 2 month	93(28.8)	60 (64.5%)	0.96 (0.79-1.15)	0.632		
> 2 months	73(22.6)	50 (68.5%)	1.01 (0.84-1.23)	0.882		
<b>Baseline non-suppressed viral load test result (Copies/ml)</b>						
≥ 10,000	140(43.3)	75 (53.6%)	1		1	
5,000-10,000	35(10.8)	20 (57.1%)	1.07 (0.77-1.48)	0.698	1.19 (0.86-1.66)	0.296

1,000-4,999	148(45.8)	121 (81.8%)	1.53 (1.28-1.81)	<b>&lt;0.001</b>	1.47 (1.26-1.73)	<b>&lt;0.001</b>
<b>ART regimen at time of VL non-suppression</b>						
EFV Based regimen	143(44.3)	84 (58.7%)	1		1	
NVP Based regimen	61(18.9)	32 (52.5%)	0.89 (0.68-1.18)	0.422	0.89 (0.68-1.15)	0.367
ATV/r Based regimen	36(11.1)	28 (77.8%)	1.32 (1.06-1.65)	<b>0.013</b>	1.29 (1.03-1.60)	<b>0.025</b>
DTG Based regimen	64(19.8)	61 (95.3%)	1.62 (1.40-1.88)	<b>&lt;0.001</b>	1.55 (1.33-1.80)	<b>&lt;0.001</b>
LPV/r Based regimen	19(5.9)	11 (57.9%)	0.99 (0.66-1.48)	0.944	0.96 (0.66-1.41)	0.848

## Figures

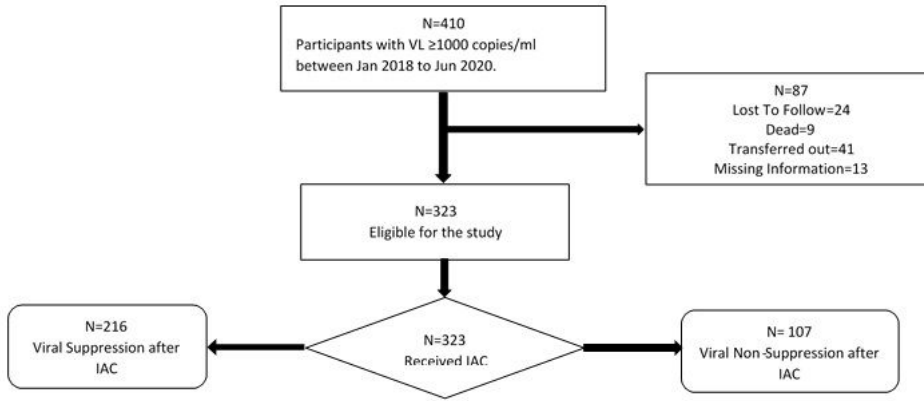


Figure 1

Illustration of the study profile

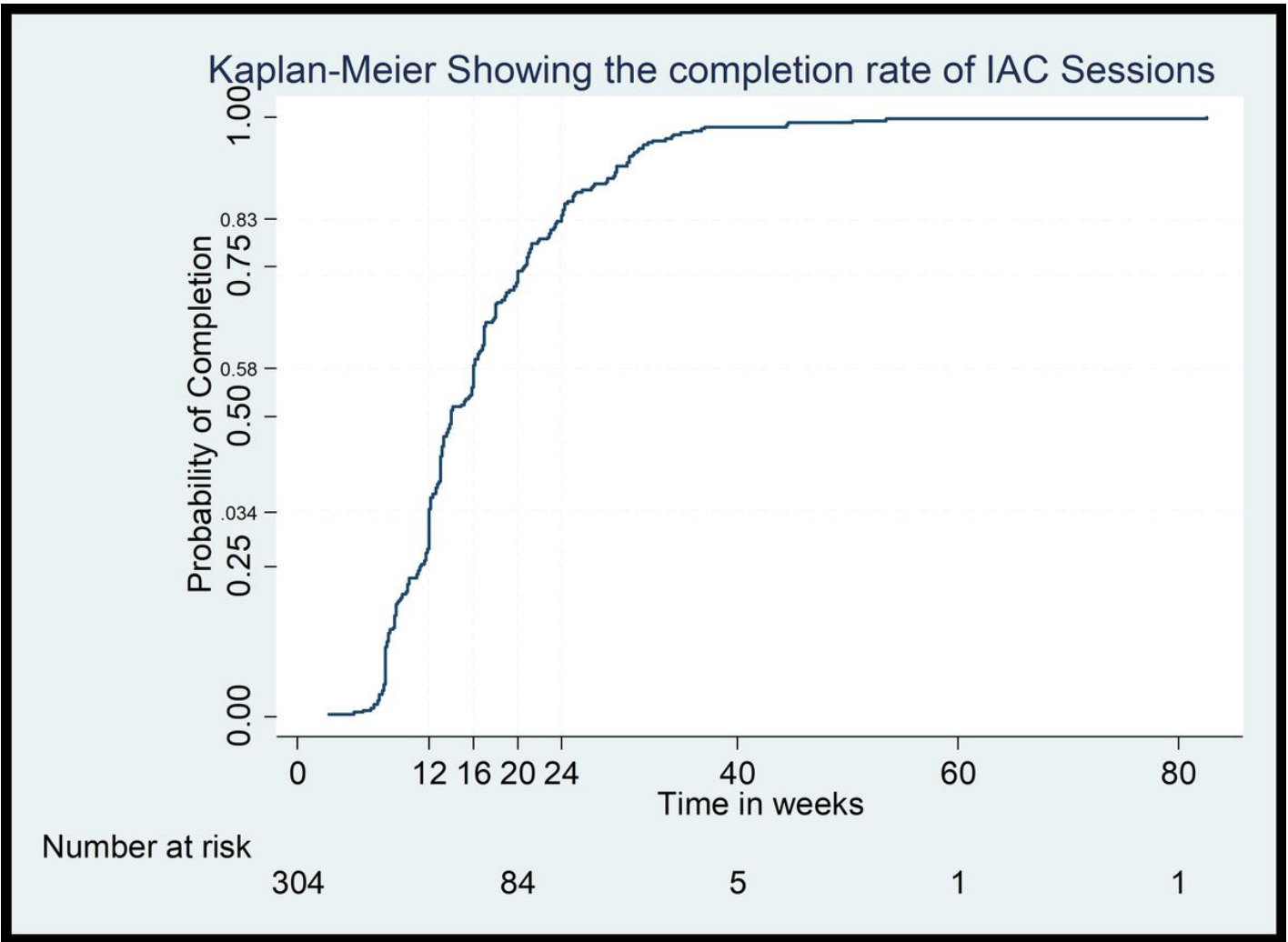


Figure 2  
 Kaplan–Meier survival curve showing the completion rate of IAC sessions in the study population of participants who received three or more sessions