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Risk factors affecting adherence to antiretroviral therapy among HIV patients in Manila, Philippines: a baseline cross-sectional analysis of the Philippines Connect for Life Study

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***Background*:** The Philippines HIV epidemic is one of the fastest growing, globally. Infections among men who have sex with men (MSM) are rising at an alarming rate, necessitating targeted evidence-based interventions to reach epidemic control. Treatment as prevention is a key strategy to end AIDS, making it a priority to explore novel approaches to retain people living with HIV (PLHIV) in care, support adherence, and reach viral suppression. ***Methods*:** This cross-sectional analysis describes HIV-related risk behaviours and adherence to antiretroviral therapy (ART) in a population of HIV-positive patients at a clinic in Metro Manila, Philippines participating in the Philippines Connect for Life™ cohort study. ***Results*:** Among 426 HIV-positive adults taking ART, 79% reported ≥95% adherence over the prior 30 days. Longer time on treatment was associated with reduced adherence to ART (adjusted odds ratio (AOR) = 0.87 per year, $P = 0.027$). Being in a serodiscordant relationship, in which the subject's primary partner was HIV negative, increased adherence (AOR = 3.19, $P = 0.006$). Inconsistent condom use (AOR = 0.50, $P = 0.103$) and injection drug use (AOR = 0.54, $P = 0.090$) are potentially associated with reduced adherence to ART. Patients used drugs and alcohol at significantly higher rates than the general population. ***Conclusions*:** The study found that patients in this setting require intervention to address treatment fatigue. Interventions to improve social support of PLHIV, as well as

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harm-reduction approaches for drug and alcohol use, could improve adherence in this population, strengthening the test-and-treat strategy to control the epidemic.

Keywords: adherence, antiretroviral therapy, Asia, evidence-based policy, harm reduction, HIV/AIDS, men who have sex with men, people living with HIV, Philippines.

We conducted a study in the Philippines, where the HIV/AIDS epidemic is concentrated among young men who have sex with men (MSM), to better understand adherence to antiretroviral therapy (ART) among this key population. In our study population of 462 HIV-positive patients, predominantly young MSM, 79% of patients were adherent to their ART. We found that longer time on treatment led to lower adherence, and that social support and substance use were important factors.

Introduction

The Philippines has the fastest growing HIV/AIDS epidemic in the Asia–Pacific region.[1–3] National surveillance data show that the number of new HIV cases in the Philippines has risen at an alarming rate during the past decade, with an increase from 311 cases identified in 2007 to 11 427 cases identified in 2018 – a 36-fold increase in new HIV diagnoses.[4] According to the Joint United Nations Programme on HIV/AIDS (UNAIDS)'s surveillance reports, the Philippines' progress towards reaching HIV/AIDS 90–90–90 goals is slow, with 67% of people living with HIV (PLHIV) aware of their status, 48% of those who know their status on treatment, and low coverage of viral load testing (<50%).[5]

Young men who have sex with men (MSM) are the key population in this emerging epidemic. Early in the HIV epidemic, most diagnoses were among heterosexual females, especially sex workers. Today, 85% of new cases are in MSM, the median age of new cases in the Philippines is 28 years, and more than 80% of people living with HIV/AIDS in the Philippines are aged under 35 years.[4] In 2015, a national surveillance survey found that HIV prevalence among MSM who practice anal sex was 6%, an increase from 3.3% in 2013.[6–8]

As the burden of HIV increases, it is imperative that as many HIV-infected people as possible are diagnosed, started on treatment and successfully retained in care. Achieving adequate viral suppression through the use of antiretroviral therapy (ART) will be one of the key tools in ending the HIV epidemic in the Philippines. Unfortunately, widespread stigma, lack of knowledge, and barriers to accessing care pose a challenge to engaging patients in testing and then ensuring high levels of adherence to ART and retention in care.[6,8,9] As in many developing countries, high rates of first-line treatment failure, loss to follow up, and suboptimal treatment adherence lead to poor outcomes for many HIV patients in the Philippines.[10,11]

Evidence-based public health interventions are needed. However, a 2015 report by the World Health Organization (WHO) highlights that the body of HIV research conducted in the Philippines

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has been limited,[12] and a systematic review of the HIV risk studies in the Philippines through April 2018 found only three publications that included data about the group most affected by HIV, MSM.[13]

This study aims to describe the demographic profile, clinical characteristics, HIV-related risk behaviours, quality of life (QOL), and ART adherence levels in a population of HIV-positive individuals comprised primarily of MSM receiving treatment at the Sustained Health Initiatives of the Philippines (SHIP) Clinic in Metro Manila, Philippines.

Methods

Study design, participants, and setting

A cross-sectional analysis was conducted using data from the baseline visit of a cohort study of patients at the SHIP clinic. The purpose of the larger cohort study was to evaluate the Connect for Life™ mobile phone adherence support intervention. Data were collected from October 2016 to December 2018.

The SHIP Clinic is a public–private partnership, low-cost, fee-for-service facility in Mandaluyong, Metro Manila, which has provided HIV treatment and a comprehensive package of primary healthcare services to more than 900 patients since it opened in 2012. SHIP is a satellite partner clinic of the STI/AIDS Guidance Intervention & Prevention Unit at the Philippine General Hospital.

All patients starting or continuing on ART at the SHIP clinic who had a mobile phone and who spoke English (one of the two official languages in the Philippines and spoken fluently by nearly all of the patients from the study site) were eligible to participate in the study. Mobile phones were required because all patients who were enrolled would receive a mobile phone adherence intervention. The study coordinator approached patients during their routine clinic visits to provide information about the study and complete the informed consent process.

Measures

At the baseline study visit, the study coordinator collected demographic data and extracted medical history from the patient charts. Each participant completed a questionnaire on HIV-related knowledge, attitudes and practices (KAP) that was specific to the mobile phone adherence intervention and the WHO HIV Quality of Life questionnaire (WHO QOL-HIV BREF https://www.who.int/mental_health/publications/whoqol_hiv_bref.pdf). Patients who had taken ART before also completed an adherence questionnaire that was adapted from the AIDS Clinical Trials Group tools. All questionnaires were in English. The questionnaires were self-administered, with assistance from the study coordinator as requested.

The self-reported adherence measure used a visual analogue scale (VAS) in which patients reported the proportion of ART doses taken in the prior 30 days from 0–100%. For ART to be effective, it should be taken consistently, and early studies reported that ≥95% adherence to ART was required to

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achieve and maintain viral suppression.[14,15] More recent studies have shown that virological suppression may be achieved with adherence levels <95%; however, this is dependent on the duration of treatment and the ART regimen.[16–18] Therefore, in this analysis, those who took ≥95% of their ART doses were considered adherent, and <95% as non-adherent.

Statistical analysis

Descriptive data analysis was conducted to categorise the study population. Categorical variables were described with proportions and continuous variables were described with means and confidence intervals. We examined which characteristics of individuals were associated with adherence to ART of >95%. Crude odds ratios (ORs) were calculated with logistic regression to examine which demographic, behavioural, and clinical factors are related to self-reported adherence. Factors significant at *P*-value <0.1 on univariate analysis were included in a multivariate logistic regression analysis. Clinical variables were excluded from the multivariate if there was plausible reverse causality between ART adherence and the clinical characteristics (i.e. viral load suppression). Where possible, continuous variables were used in the multivariate model, whereas categorical variables were used for illustrative purposes in the crude OR descriptive analyses. Data analysis was conducted in Stata 15 (StataCorp LLC).

Ethics

Ethical clearance was obtained from the University of the Philippines Manila Research Ethics Board (protocol number 2016–265–01) and from the London School of Hygiene and Tropical Medicine (reference number 11631). All patients provided written consent before inclusion in the study.

Results

The cross-sectional analysis included 426 individuals. Variables were included in the following categories: Demographics, Clinical Characteristics, HIV Knowledge, Risk Behaviours, QOL, Adherence/Reasons for Missing Medication.

At the time study enrolment began, the clinic had ~600 active patients. The study coordinator screened 485 patients as they presented during routine clinic visits, of whom 483 were eligible to participate in the study (one did not speak English, one did not have a Philippine mobile phone), and 462 patients provided consent and were enrolled (of the 21 who declined, the most common reason was that they did not want to receive calls or SMS related to the intervention). Of 462 people enrolled in the Connect for Life intervention study, 31 were either ineligible to fill out the adherence questionnaire (initiated ART at the study baseline visit and had not started taking pills) or had missing questionnaires; as a result 426 individuals reported ART adherence, and are included in this analysis. All but one of these 426 subjects were male (99.8%), and almost all were MSM (419/426 or 98.4%).

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The mean age was 32.4 years. University or post-graduate studies had been completed by 86% of participants (365/426), and 91% were employed (389/426), which reflects the higher socioeconomic status of patients who access private fee-for-service care.

Perfect adherence of 100% of doses taken in the last 30 days was reported by 52.1% (222/426), 95–99% was reported by 26.6% (113/426), adherence of 90–94% was reported by 12.7% (54/426), and adherence of <90% was reported by 8.7% (37/426) of patients.

Medical history was extracted from patient files and included time on ART, nadir CD4 count, history of opportunistic infections (OIs), current and past ART medications and regimen changes, viral load suppression, and CD4 recovery. Various sociodemographic and clinical factors and their association with self-reported adherence to ART at ≥95% are reported in Table 1.

Patient demographic and clinical characteristics

Demographics

There is evidence to suggest that low education level is associated with non-adherence (OR = 0.20, $P = 0.031$). There was no strong evidence of associations between employment/profession or age and adherence.

Patients working in the Business Process Outsourcing (BPO) sector had lower adherence than other professions; this may be due to the varying shift times worked by call centre agents in this sector. Health workers had the highest adherence of any profession, followed by self-employed individuals. However, overall, there was no strong evidence of association between employment/profession and adherence.

Relationship status appears to be an important factor in ART adherence. Of the 27.9% of subjects (119/426) who were in a relationship, most were in a serodiscordant relationship in which their primary partner was HIV negative. Those in serodiscordant partnerships had improved odds of adherence to ART compared with individuals who were not in a relationship (OR = 2.49). The evidence suggests that being in seroconcordant relationships (both HIV positive) and disclosure of HIV status to a trusted person may be also be factors that improve adherence; however, the sample size in this study was insufficient to reach these conclusions with confidence.

Adherence and viral suppression

Self-reported adherent patients were more likely to be virally suppressed (OR = 3.1, $P = 0.016$).

Time on ART and virological failure

Having been on ART for a longer time led to decreased adherence (0–6 months: OR = 1.00; 6 months−1year: OR = 0.36; 1–2 years: OR = 0.43; 2–4 years: OR = 0.32; ≥4 years: OR = 0.25; $P = 0.013$), which indicates that patients may be experiencing treatment fatigue over time.

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In total, 27.9% of patients (119/426) had changed their ART medications at least once. Of those who changed regimens, 17.7% (21/119) had to change due to virological failure, whereas the remaining 98 people changed for other reasons such as intolerance/side-effects or depression worsened by efavirenz (EFV). Only 7.5% of patients (32/426) were on second-line lopinavir/ritonavir (LPV/r) or multiple resistance ART regimens, whereas 92.5% (394/426) were on efavirenz, nevirapine, or rilpivirine-based first-line ART regimens.

CD4 and opportunistic infections history

Most patients had a nadir CD4 count in the range of 200–350 cells/mm^3, indicating that they were diagnosed and started on ART before disease progression to AIDS. However, 74 patients (17.4%) had nadir CD4 count <50 cells/mm^3, indicating that they did not receive HIV diagnosis and treatment until they were already severely immune-compromised. Only 51.5% (206/400) of patients who had a nadir CD4 count <500 cells/mm^3 had reached CD4 recovery back to levels <500 cells/mm^3.

History of OI was common, with 61% of patients (260/426) having one or more potential OIs recorded in their complete medical history. Pnuemocystis pneumonia (PCP) history was recorded in the medical history of 6% of patients (27/426), and 5% had a history of thrush (20/426). Hepatitis B at 11% (46/426) and tuberculosis (TB) history at 18% (76/426) are similar to the overall population rates of these diseases, which are endemic to the Philippines.[19,20] Hepatitis C prevalence was 0.7% in our cohort (3/426), which is also similar to the general population rate.[19] Over 13% of patients (57/426) had a history of syphilis and 39% (166/426) had had another sexually transmissible infection (STI). There was no evidence of an association between ART adherence and nadir CD4, CD4 recovery, or OI history.

Risk behaviours

The association between risk behaviours and ART adherence is outlined in Table 2.

Sexual partners and condom use

The mean number of sex partners for participants in the last 6 months was 2.73. Among participant 21.8% reported zero partners (93/426), 32.2% reported one partner (137/426), 23.2% reported between two and nine partners (99/426), and 4.2% reported >10 partners (18/426), whereas 20.9% (89/426) of participants did not provide an answer on the questionnaire. Only 6% (25/426) of the patients reported having ever engaged in transactional sex, and of those, only two participants had had transactional sex within the last 6 months. In the study population, 41.3% (176/426) reported they always use condoms and 35.4% (151/426) use them some of the time or most of the time. This inconsistent condom use was associated with non-adherence to ART (OR = 0.48, P = 0.007); however, individuals who reported never using condoms did not have reduced odds of ART adherence.

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Drug and alcohol use

In our study population, 9.4% (40/426) used 'shabu' (methamphetamine hydrochloride), 8.0% (34/426) used cannabis, 4.5% (19/423) used prescription drugs for non-medical use, and 1.4% (6/426) used inhalants (e.g. 'rugby' or 'poppers') within the last 3 months, and 0.7% (3/426) of respondents did not complete the substance use portion of the questionnaire. Injecting drug users (IDU) were 12.2% (52/426) of the study population; 52 who had ever injected drugs and 28 who had done so within the last 3 months. Among IDUs, the odds of ART adherence were lower (IDU ever OR = 0.46, $P = 0.015$; IDU in last 3 months OR = 0.38, $P = 0.019$). Only two individuals reported ever having shared needles for injecting drugs. There was no association between adherence and non-injecting drug use.

Although 30.5% (130/426) of patients abstained from alcohol, 37.3% (159/426) engaged in heavy episodic drinking in the last 30 days. Problem drinking, defined as two or more episodes of heavy episodic or 'binge' drinking (>five drinks) in the last month or >14 drinks per week on average,[21,22] was prevalent in 13.4% (57/426) of the study population. Alcohol use did not have an association with ART adherence.

Quality of life

The WHO HIV-QL31 scores QOL in six domains, a maximum of 20 points per domain and a total score of 120. The mean for each of the six domains and the total WHO HIV-QL31 score are as follows: Physical 15.21; Psychological 15.04; Level of Independence 15.54; Social Relationships 15.01; Environmental 13.43; and Spirituality 14.44. The domain with the lowest overall score was Environment, which measures aspects such as safety and security; access to health care; financial resources; opportunities for learning and for leisure; and physical environment (pollution/noise/traffic/climate).[23]

The mean QOL score in the cohort was 88.68 (95% CI 87.46–89.89). Just under half (46.5%) of the 426 participants had an overall QOL score of ≥90, which represents a high QOL, and 52.3% percent had a medium QOL with a score between 60 and 89. Only five patients (1.3%) had a QOL score <60. One patient did not complete the QOL questionnaire. There was no significant association between ART adherence and overall QOL (Table 2) or individual QOL domains (data not shown).

Knowledge of HIV

There was evidence of an association between knowledge of HIV, as scored on a 16-item questionnaire, and ART adherence. There is an association between scoring 80% and 89% on the HIV knowledge questionnaire and lower adherence (OR = 0.49, $P = 0.044$). This association does not hold for those scoring >90% and the reason for the association is unclear, warranting further investigation.

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Adherence/reasons for missing medication

There were 228 study participants who reported having missed medications at any point in the past; the reasons they reported for ever missing medications are detailed in Figure 1. The most common reasons for missing medications were that that the patient was busy, they forgot, fell asleep, was away from home, or had a change in their daily routine. Stigma is also a factor affecting adherence, as 44% of patients who had skipped a pill at some point did so because they did not want to be seen taking medications. Issues around side-effects, toxicity, and pill burden were the least likely contributors to non-adherence.

Multivariate logistic regression model for adherence to antiretroviral therapy

In the final multivariate logistic regression model (Table 3), time on ART (adjusted OR (AOR) = 0.87 per year, $P = 0.027$ seroconcordant/serodiscordant relationship status ($P = 0.006$)), and knowledge score ($P = 0.047$) were associated with ART adherence. Injection drug use and inconsistent condom use (using condoms sometimes or most of the time) may also be related to adherence, whereas the study sample may have been too small to evaluate these factors.

Discussion

Twenty-one percent (91/426) of the study participants reported suboptimal adherence. By comparison, ~37% of patients globally report suboptimal adherence to ART,[17,24] and in the regional Therapeutics Research, Education, and AIDS Training in Asia (TREAT Asia) cohort (which includes a large treatment site in the Philippines), 32% of 1316 patients reported suboptimal adherence of <100%.[11] As expected, self-reported adherent patients were more likely to be virally suppressed, which indicates that patient self-report of adherence or non-adherence accurately reflects their pill-taking behaviour.

The study found that people who had been on treatment longer were less likely to be adherent to their ART. This finding is contrary to the TREAT Asia regional cohort study, which found 26% of patients self-reported suboptimal adherence levels during their first 6 months of treatment, and that adherence improved over time from initiation to 24 months.[11] These contradictory findings warrant further investigation. Reasons for non-adherence in this study were largely situational factors, habits, and routines, whereas clinical issues such as side-effects and pill burden were less likely to impact adherence in this population.

Condom use in this study population was comparable to the general MSM population in the Philippines – 41.3% (146/405) of the sexually active SHIP population study participants always use condoms and 35.5% (151/405) use condoms most or some of the time, whereas the 2013 surveillance data showed 40.7% condom use at last anal sex among MSM.[8,25] Inconsistent condom use (using condoms sometimes or most of the time) may be associated with ART non-adherence, which suggests that motivating factors and abilities that enable a patient to adhere to ART could also be the same

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factors that lead to consistent condom use. The average total number of sex partners in the last 6 months was 2.14, which is lower than has been reported in other surveillance of MSM in the Philippines;[8,25] this may indicate that MSM reduce their sexual activity after becoming HIV positive and starting ART, a question that warrants further investigation.

Relationship status appears to be an important factor in ART adherence. Patients in serodiscordant relationships were more likely to adhere to ART. The data suggest that being in a relationship, whether seroconcordant or serodiscordant, is better than being single when it comes to ART adherence, and that disclosure of one's HIV-positive status to a trusted person can also lead to better outcomes. These findings emphasise the important role of partner, family and social support for HIV patients in order to achieve good clinical outcomes.

Another key finding in this study is that the study participants used drugs and alcohol at rates five- to 10-fold higher than the general population. In the Philippines general population, 44.7% of males abstain from alcohol and 3.5% of males engage in heavy episodic drinking,[26] whereas in our study population, only 30.5% abstained and 37.3% had engaged in heavy episodic drinking in the last 30 days. According to the United Nations Office on Drugs and Crime, 1.1% of Filipinos use 'shabu' (methamphetamine hydrochloride) and 1.6% use cannabis.[27] In our study population, 9.9% had used 'shabu' and 7.7% used cannabis within the last 3 months. Methamphetamine use is strongly associated with high-risk sexual behaviour and HIV acquisition,[28] and is commonly used by MSM in chemsex or 'Partee 'n' Play' activities. Compounding these risks, evidence-based HIV prevention services are not widely available in the Philippines – condom distribution is restricted,[29,30] pre- and post-exposure prophylaxis are not widely available, except through very limited pilot projects, and syringe exchange is illegal under the current administration's interpretation of the Philippines' Dangerous Drugs Act of 2002.

Limitations

This study is limited by several factors. First, adherence and risk behaviours were self-reported, and the responses are subject to social desirability bias. However, adherence was strongly associated with viral load suppression, and risk behaviours were not significantly lower than the general population (and in many cases much higher), which suggests that the self-report method was generally accurate. Furthermore, the generalisability of study data from the SHIP clinic population is limited. Due to the higher socioeconomic status and education levels of the SHIP clinic patients, and due to the fact that it is a fee-for-service clinic, the cohort may not be representative of MSM in the Philippines more broadly. Apart from employment, education, and high HIV knowledge levels, other demographic factors (age, clinical outcomes, risk profile) align with other published data on MSM and people living with HIV from the country.[7,8,25,31] Ongoing follow up of the SHIP Connect for Life study cohort will provide further details about incidence of OIs, retention in care, and ART adherence.

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Conclusions

This study provides an in-depth analysis of demographic, clinical, and behavioural characteristics of MSM living with HIV in the Philippines, which can improve understanding of the country's epidemic and may be used to inform tailored prevention and treatment interventions.

Factors found to be associated with adherence to HIV treatment were time on ART, being in a serodiscordant relationship in which the person's main partner is HIV negative, and HIV knowledge level.

The issue of treatment fatigue warrants further investigation and should be addressed through implementation of tailored adherence interventions. Clinicians and other service providers should prioritise counselling and interventions to improve family and social support for HIV patients. There is also an unexplored opportunity for harm-reduction interventions among HIV-positive and HIV-negative MSM who use drugs and alcohol.

Conflicts of interests

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Fig. 1. Reasons for missing medication (*n* = 228).

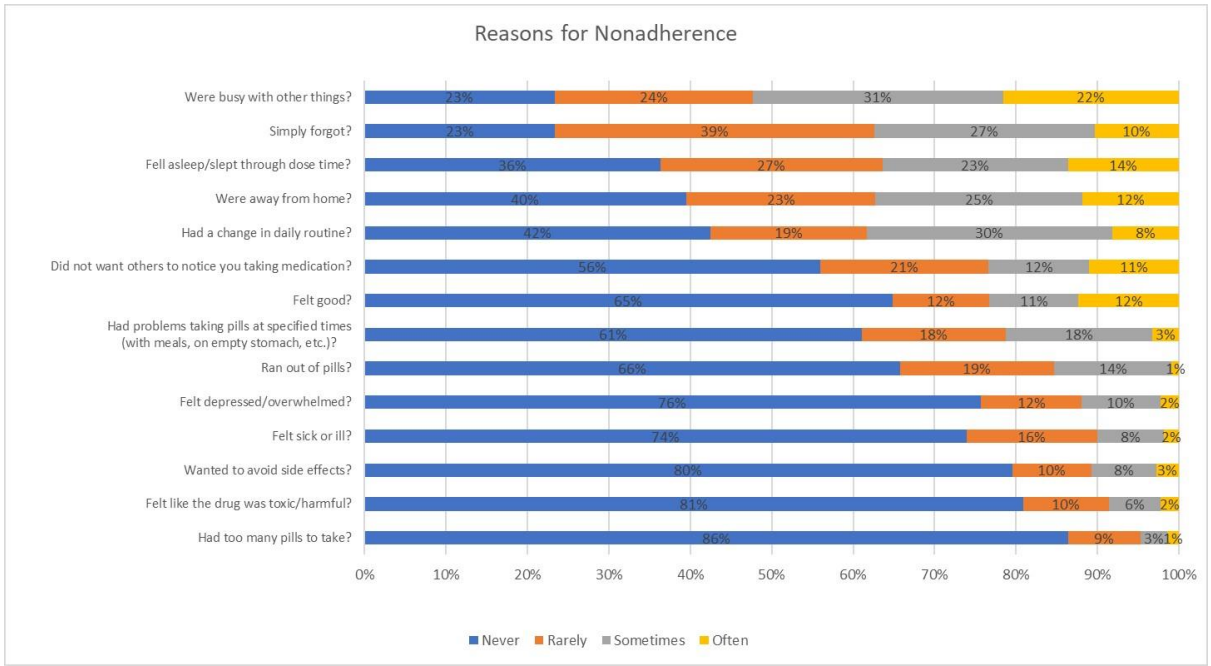

Table 1. Patient characteristics

OR, odds ratio; CI, confidence interval; ART, antiretroviral therapy

Patient characteristics	Total	Adherent ≥95%	Non-adherent <95%

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	(*n* = 426) *n*	(%)	(*n* = 335) *n*	(%)	(*n* = 91) *n*	(%)	Crude OR (95% CI)	*P*-value
Gender								
Male	425	99.77	334	78.59	91	21.41	–	
Female	1	0.23	1	100.00	0	0.00	–	
Age (years)								
18–24	19	4.46	17	89.47	2	10.53	1.00	
25–29	119	27.93	95	79.83	24	20.17	0.47 (0.10–2.16)	0.498
30–39	245	57.51	188	76.73	57	23.27	0.39 (0.09–1.73)	
≥40	43	10.09	35	81.40	8	18.60	0.51 (0.10–2.69)	
Education								
Elementary or less	10	2.35	4	40.00	6	60.00	0.20 (0.05−0.72)*	
High School/Vocational	19	4.46	15	78.95	4	21.05	1.11 (0.36–3.44)	0.010*
College/University	316	74.18	244	77.22	72	22.78	1.00	
Post-Graduate	49	11.50	44	89.80	5	10.20	2.60 (0.99–6.79)	
Unknown/Did not report	32	7.51	28	87.50	4	12.50	2.07 (0.70–6.08)	
Employment								
Business Process Outsourcing (BPO)	88	20.66	66	75.00	22	25.00	1.00	
Self-Employed/Other	38	8.92	34	89.47	4	10.53	2.83 (0.90–8.89)	
Health Worker	16	3.76	15	93.75	1	6.25	5.00 (0.62–40.06)	0.406
Professional[A]	234	54.93	182	77.78	52	22.22	1.17 (0.66–2.07)	
Student	13	3.05	10	76.92	3	23.08	1.11 (0.28–4.41)	
Unemployed	37	8.69	28	75.68	9	24.32	1.04 (0.42–2.53)	
Sexual orientation								
Bisexual	128	30.05	96	75.00	32	25.00	1.00	
Heterosexual	7	1.64	6	85.71	1	14.29	2.00 (0.23–17.25)	0.467
Homosexual	290	68.08	232	80.00	58	20.00	1.33 (0.81–2.18)	
Pansexual	1	0.23	1	100.00	0	0.00	–	
Civil status								
Married/Common-law partner	21	4.93	19	90.48	2	9.52	1.00	
Single	404	94.84	315	77.97	89	22.03	0.47 (0.11–2.10)	0.282
Unknown/Did not report	1	0.23	1	100.00	0	0.00	–	
Serodiscordant								
Not in a relationship	262	61.50	199	75.95	63	24.05	1.00	
Seroconcordant relationship (both HIV+)	48	11.27	41	85.42	7	14.58	1.85 (0.79–4.34)	
Serodiscordant relationship (partner is HIV−)	71	16.67	63	88.73	8	11.27	2.49 (1.13–5.48)*	0.030*
Unknown/Did not report	45	10.56	32	71.11	13	28.89	0.78 (0.39–1.58)	

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Disclosure of HIV status to family/friend								
Disclosed	137	32.16	113	82.48	24	17.52	1.00	
Not disclosed	207	48.59	155	74.88	52	25.12	0.63 (0.37–1.09)	0.181
Unknown/Did not report	82	19.25	67	81.71	15	18.29	0.95 (0.47–1.93)	
Time on ART, years (mean)	2.77 years (95% CI 2.58–2.96)		2.61 (2.40–2.82)		3.35 (2.90–3.79)			
0–6 months	46	10.80	42	91.30	4	8.70	1.00	
6 months – 1 year	38	8.92	30	78.95	8	21.95	0.36 (0.10–1.3)	
1–2 years	83	19.48	68	81.93	15	18.07	0.43 (0.13–1.39)*	0.078
2–4 years	162	38.03	125	77.16	37	22.84	0.32 (0.11−0.96)*	
>4 years	97	22.77	70	72.16	27	27.84	0.25 (0.08−0.75)*	
Nadir CD4 (cells/mm^3) (Mean)	245 (95% CI 229–260)		246 (227–263)		244 (212–275)			
0–200	163	38.26	132	80.98	31	19.02	1.00	
200–499	237	54.76	179	75.53	58	24.47	0.72 (0.44–1.18)	0.065
500+	26	6.93	24	92.31	2	7.69	2.82 (0.63–12.56)	
Viral Suppression								
Undetectable	257	92.45	207	80.54	50	19.46	3.11 (1.24–7.77)	0.020
Detectable (>500 copies)	21	7.55	12	57.14	9	42.86	1.00	*

*Adherence is self-reported over the last 30 days.

[A]'Professional' is a broad category that includes patients who work as corporate or government employees, and workers in the education, IT, science, engineering, media, and sales and marketing sectors.

Table 2. Association between risk behaviours and antiretroviral therapy adherence

OR, odds ratio; CI, confidence interval; N/A, not applicable

	Total (*n* = 426)		Adherent ≥95% (*n* = 335)		Non-adherent <95% (*n* = 91)		Crude OR (95% CI)	*P*-value
	n	(%)	*n*	(%)	*n*	(%)		
Condom usage in last 6 months								
Always	176	41.31	146	82.95	30	17.05	1.00	
Sometimes/Most of the time	151	35.45	106	70.20	45	29.80	0.48 (0.29–0.82)*	0.043*
Never	78	18.31	66	84.62	12	15.38	1.13 (0.54–2.35)	
N/A (not sexually active)	21	4.93	17	80.95	4	19.05	0.87 (0.27–2.78)	
Transactional sex								
Never had transactional sex	399	93.66	314	78.70	85	21.30	1.00	0.662
Ever had transactional sex	25	5.87	20	80.00	5	20.00	1.08 (0.39–2.97)	

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Unknown/Refused	2	0.47	1	50.00	1	50.00	0.27 (0.02–4.37)	
Drug use in last 3 months								
No	356	83.57	282	79.21	74	20.79	1.00	0.519
Yes	70	16.43	53	75.71	17	24.29	0.82 (0.45–1.50)	
Injection drug use ever								
No	374	87.79	301	80.48	73	19.52	1.00	0.018*
Yes	52	12.21	34	65.38	18	34.62	0.46 (0.25–0.86)*	
Heavy alcohol use								
No	363	86.43	289	79.61	74	20.39	1.00	0.201
Yes	57	13.57	41	71.93	16	28.07	0.66 (0.35–1.23)	
Quality of life (QOL)	88.68 (95% CI 87.46–89.89)		89.45 (88.13–90.76)		85.85 (82.97–88.73)			
High (90–120)	183	46.45	148	80.87	35	19.13	1.00	0.427
Medium (60–89)	206	52.28	159	77.18	47	22.82	0.80 (0.49–1.31)	
Low (0–59)	5	1.27	3	60.00	2	40.00	0.35 (0.06–2.20)	
HIV knowledge Score (mean, %)	85.01% score (95% CI 83.74–86.29)		85.01% (83.53–86.49)		85.03% (82.54–87.51)			
<80	95	22.35	80	84.21	15	15.79	1.00	0.044*
80–89	163	38.35	118	72.39	45	27.61	0.49 (0.26–0.94)*	
≤90	167	39.29	136	81.44	31	18.56	0.82 (0.42–1.62)	

Table 3. Multivariate logistic regression analysis of factors associated with antiretroviral therapy (ART) adherence

OR, odds ratio; CI, confidence interval; N/A, not applicable

Variable	Adjusted OR	95% CI	*P*-value
Education			
Elementary or less	0.42	(0.10–1.75)	0.084
High School/Vocational	1.16	(0.36–3.82)	
College/University	1.00		
Post-Graduate	2.40	(0.87–6.63)	
Unknown	2.57	(0.81–8.16)	
Serodiscordant			
N/A not in a relationship	1.00		0.006*
Seroconcordant relationship (both HIV+)	2.37	(0.95–5.93)	
Serodiscordant relationship (partner is HIV−)	3.19	(1.39–7.35)	
Unknown	0.81	(0.37–1.79)	
Time on ART, years	0.87	(0.77–0.98)	0.027*

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Nadir CD4 (cells/mm^3)			
0–200	1.00		
200–499	0.78	(0.46–1.33)	0.1334
500+	2.87	(0.60–13.61)	
Condom usage (in last 6 months)			
Always	1.00		
Sometimes/Most of the time	0.50	(0.28–0.89)	0.103
Never	0.81	(0.24–2.75)	
N/A (not sexually active)	0.94	(0.43–2.06)	
Injection drug use (in last 3 months)	0.54	(0.27–1.09)	0.090
HIV Knowledge Score (mean, %)			
<80	1.00		
80–89	0.47	(0.23–0.94)	0.047*
≤90	0.81	(0.39–1.67)	