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Quality of HIV care provided by non-physician clinicians and physicians in Mozambique: a retrospective cohort study

Kenneth H. Sherr^{a,e}, Mark A. Micek^{a,e}, Sarah O. Gimbel^{a,e}, Stephen S. Gloyd^{a,e}, James P. Hughes^b, Grace C. John-Stewart^c, Rosa M. Manjate^f, James Pfeiffer^{a,e}, and Noel S. Weiss^d

^aDepartment of Global Health, University of Washington, Seattle, Washington, USA

^bDepartment of Biostatistics, University of Washington, Seattle, Washington, USA

^cDepartment of Medicine, Global Health and Epidemiology, University of Washington, Seattle, Washington, USA

^dDepartment of Epidemiology, University of Washington, Seattle, Washington, USA

^eHealth Alliance International, Seattle, Washington, USA

^fMedical Care Department, Mozambique Ministry of Health, Maputo, Mozambique

Abstract

Objectives—To compare HIV care quality provided by non-physician clinicians (NPC) and physicians.

Design—Retrospective cohort study assessing the relationship between provider cadre and HIV care quality among non-pregnant adult patients initiating antiretroviral therapy (ART) in the national HIV care programme.

Methods—Computerized medical records from patients initiating ART between July 2004 and October 2007 at two HIV public HIV clinics in central Mozambique were used to develop multivariate analyses evaluating differences in process and care continuity measures for patients whose initial provider was a NPC or physician.

Results—A total of 5892 patients was included in the study, including 4093 (69.5%) with NPC and 1799 (30.5%) with physicians as initial providers. Those whose initial provider was a NPC were more likely to have a CD4 cell count 90–210 days [risk ratio (RR) 1.13, 1.04<RR<1.23] and 330–390 days (RR 1.12, 0.96<RR<1.31) after initiating ART. A large majority of patients adhered well to care, although patients whose initial provider was a NPC had more frequent clinical visits in the first year post-ART initiation (RR 1.02, 1.00<RR<1.05) and higher levels of adherence to antiretroviral medicines in the first 6 months after initiating ART (RR 1.05, 1.02<RR<1.09). Patients of NPC were less likely to be lost to follow-up than those seen by physicians (RR 0.86, 0.73<RR<1.02).

Conclusion—NPC performance was similar to or better than that of physicians for the HIV care quality study measures. Our results highlight the important role of NPC in scaling up ART in

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Correspondence to Kenneth H. Sherr, Department of Global Health, University of Washington, Seattle, Washington, USA. Tel: +1 206 543 8382; ksherr@u.washington.edu.

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Mozambique, and argue for using all relevant clinical resources to meet the large demands for care in countries with high HIV burdens.

Keywords

antiretroviral therapy; Mozambique; non-physician clinicians; scale-up; task shifting

Introduction

Since the UN General Assembly on HIV/AIDS in 2001, global investment directed to controlling the HIV epidemic has greatly increased, resulting in over US\$10 billion in funding for HIV programmes in resource-limited countries in 2008 [1]. This political and financial commitment facilitated the rapid expansion of antiretroviral therapy (ART) in the most highly HIV-affected countries in the world. An estimated 70% of eligible patients, however, still had not received ART by the end of 2007, largely because weak health systems hamper efforts to reach universal coverage [2].

The scarcity of human resources is a prominent feature of weak health system capacity, impeding the absorption of increased development aid and threatening efforts to achieve an ambitious global health agenda [3,4]. The World Health Organization estimates that an additional 4 million health workers are required to achieve the 2015 millennium development goals, including 1 million in sub-Saharan Africa, which has both the lowest density of health workers and the highest disease burden in the world [5]. In conjunction with comprehensive efforts to build human resource capabilities, task shifting, or delegating clinical and programme responsibilities to existing lower-level cadres such as non-physician clinicians (NPC), has been recommended as a strategy for meeting the demands of priority health initiatives, such as universal access to ART [6–8].

The use of NPC is not new in sub-Saharan Africa, although there is little uniformity in their regulatory status and nomenclature, with titles such as health officers, clinical officers, physician assistants, nurse practitioners, and in Mozambique, técnicos de medicina. The imperative to increase access to clinical HIV services has placed particular emphasis on expanding the scope of NPC activities, and in Mozambique expansion of HIV care, including ART management, has greatly relied on this clinical cadre [9].

Despite the increased reliance on NPC, questions remain about their ability to provide safe and effective care [10–13], especially in developing country settings where fewer evaluations have been conducted. Results from randomized controlled trials [14,15] and meta-analyses [16–20] conducted in industrialized nations have shown that safe, quality care is provided by NPC compared with physicians. One study from the United States found NPC provided statistically equivalent HIV care quality when compared with physicians [21].

In contrast, in resource-limited countries, most studies have been descriptive, typically assessing aggregate patient outcomes when NPC work along with physicians compared with physician-only care [22–25]. When comparative studies have been conducted, most focus on obstetric services. Those studies have found similar postoperative outcomes for both NPC and physicians [26–30]. Research on HIV care in Africa found similar results for NPC-led clinics compared with other settings [31,32], whereas results from a training evaluation in Mozambique described inadequate preparation for NPC [33]; however, both studies lacked appropriate comparison groups. Persistent uncertainty about HIV care quality provided by NPC hampers their use for further scaling up HIV care [34]. To help expand knowledge about the effect of provider cadre on HIV care quality in resource-limited settings, we

examined a retrospective cohort study of patients initiating ART between July 2004 and October 2007 in Mozambique.

Methods

Study setting

Two public sector ambulatory HIV clinics in central Mozambique (Beira Central Hospital and Chimoio Provincial Hospital), the region that has consistently had the highest adult HIV prevalence in Mozambique, were the setting for this study. The HIV clinics opened in 2002 (Beira) and 2003 (Chimoio), although accelerated expansion of ART began in July 2004 when Mozambique adopted a public health approach to ART based on standard treatment protocols with fixed-dosed combination antiretroviral drugs provided free of charge at the point of care [10].

Study population

Study subjects included consecutive ART-naive adult patients initiating ART at the study clinics between July 2004 and October 2007. Patients were excluded from the study if they were less than 15 years of age upon ART initiation, pregnant at the time of clinic enrollment, or enrolled in a pilot ART programme (MTCT-Plus, Columbia University Mailman School of Public Health), as these patients were primarily seen by physicians. In order to ensure comparability of training between study providers, patients were excluded if their initial provider was an expatriate clinician.

Data sources

The study primarily used data from computerized databases capturing patient sociodemographic information and data from clinical, laboratory, pharmacy and social worker visits. Dedicated data entry staff maintained the databases as part of routine care, and they have built-in ranges and cross-checks to minimize data entry error. These databases were found to agree highly with patient charts (Cohen kappa scores >0.83 for key study variables). Information on study providers, such as sociodemographic characteristics, training and work experience, was collected by individual interviews by the study team. Clinic receptionists also logged clinic staff presence during a 4-week period in the second quarter of 2007 to estimate clinic full-time equivalents (FTE) for both cadres.

Variable definition and statistical analysis

Clinician classification—Study patients were grouped according to their initial assignment of primary care provider at time of clinic enrollment (NPC or physician). Designation of either physician or NPC was left to clinic discretion; however, care pathways were not designed to differ by cadre. Subanalysis was carried out among patients whose initial provider was a physician, with patients grouped by specialization (generalist/specialist). Transfers between providers were estimated from the routine clinic database to assess frequency and direction of transfer (NPC to physician, physician to NPC, or mixture), based on if a patient switched to a new provider for the duration of care at the clinic or if there was no discernable pattern.

Quality of HIV care measures—Five measures of quality of care were used, including three process measures based on ministry of health protocols [35] and two patient-level outcomes commonly used in evaluating HIV care. Outcomes were chosen based on availability and accuracy in the clinic databases, and based on their association with HIV quality of care measures in previous studies. Outcomes were assessed in a dichotomous form to facilitate analysis and interpretation.

Process outcomes included: (i) CD4 cell count evaluated between 90 and 210 days post-ART initiation; (ii) CD4 cell count evaluated 330–390 days post-ART initiation; and (iii) a clinical visit at least once per quarter for three of the first four quarters post-ART initiation. Because these measures only made sense if the patient met enrollment standards, we excluded patients from the analysis of CD4 cell count measurement at 90–210 days if they had initiated ART within 180 days before the end of the study period or if they left the clinic within the first 180 days after initiating ART for reasons not related to adherence to care (including death, transfer to another facility, or provider-initiated ART suspension). Similarly, patients were excluded from the analysis of CD4 cell count measurement 330–390 days and frequency of clinical visits during the first year of ART if they initiated ART within 365 days before the end of the study period or if they left the clinic within the first 365 days after initiating ART for reasons cited above.

The two patient-level HIV care outcomes included: (i) adherence to antiretroviral drug regimens; and (ii) patient loss to follow-up not caused by mortality. Adherence was evaluated during the first 180 days post-ART initiation, which is a commonly used timeframe [36] predictive of long-term ART adherence [37]. Using pharmacy refill data, adherence was calculated as the number of antiretroviral drug doses dispensed post-ART initiation to the first refill date after 180 days, divided by the number of doses prescribed in that period. ART adherence was classified as optimal for patients receiving 90% or more of their antiretroviral drugs, which is adequate to maintain viral suppression using drug regimens containing a non-nucleoside reverse transcriptase inhibitor (NNRTI), as is the case in Mozambique [38]. Patients lost to follow-up during the first 180 days post-ART initiation were considered to have non-optimal adherence. Patients initiating ART less than 180 days before the end of the study period and those leaving the clinic within the first 180 days of initiating ART as a result of death, transfer to another facility, or provider-initiated ART suspension were excluded from the analysis.

Patients were classified as lost to follow-up if they failed to return to the study clinic for 60 days or more after a scheduled monthly ART refill for reasons not related to patient death. The date of last pharmacy refill was used to define the endpoint for loss to follow-up. Although loss to follow-up as a result of patient death was assessed as a separate outcome, the primary outcome of interest was loss to follow-up for reasons not associated with patient death.

Covariates—Covariates were considered based on their theoretical potential to confound or modify the relationship between provider type and quality of care. Potential patient characteristics considered as confounding factors included age (calculated from date of birth to date of clinic enrollment), self-reported years of education at clinic enrollment, baseline CD4 cell count from the last CD4 cell count measurement before initiating ART, sex, socioeconomic status, distance of residence from the study clinics and study clinic.

Statistical analysis—Unadjusted analyses using chi-square for independence and two-tailed Student's *t*-tests were conducted to describe bivariate associations between covariates and provider cadre. Individual multivariate generalized linear models extended to the binomial family were used to examine the association between provider type and four outcomes, with the exception of loss to follow-up, which is described below. Risk ratios were estimated using the log-link function. Life tables were developed to estimate patient loss to follow-up at 12 and 24 months. Cox proportional hazard regression was used to assess the relationship between provider cadre and patient loss to follow-up or death (as separate outcomes). Follow-up time began at ART initiation and ended with the last pharmacy refill date for patients who died or were lost to follow-up, or censored because of transferring out of the study clinic or provider-initiated ART suspension.

Patient-level covariates were assessed for inclusion in multivariate analysis using a forward stepwise approach based on whether the covariate changed the relevant coefficient terms by more than 10%. We evaluated the study clinic as a potential effect modifier by comparing strata-specific and aggregate risk estimates for the strength and direction of association and by including interaction terms in the multivariate models, and no effect modification was confirmed on the relative scale.

Data analysis was performed using Stata version 10 (College Station, Texas, USA). The study was approved by the institutional review boards of the Mozambique Ministry of Health and the University of Washington.

Results

Study clinics

Both clinics had a high volume of HIV-infected patients, with a combined average of 668 monthly new adult enrollees (Beira 375, Chimoio 293). An average of 174 adult patients initiated ART at the clinics per month (Table 1). During the 4-week clinic observation period, 23 physicians provided a total of 1.8 FTE based on a 35-h work week, compared with 3.9 FTE from 10 NPC. Over the study period, physicians were responsible for 44.5% of all clinical consults, including both patients who had initiated ART and those not yet on ART, compared with 55.6% for NPC.

Study providers

There were 52 clinical providers in this study, including 15 (28.9%) NPC and 37 (71.2%) physicians, of whom 20 (54.1%) had completed a clinical specialty. A higher percentage of physicians were 35–44 years of age (67.7% versus 13.3%), whereas more NPC were younger than 35 (46.7% versus 11.8%) or older than 44 years (40.0% versus 20.6%) (Table 2). Physicians received more training on HIV care. Nearly three times as many NPC had less than 11 years experience in the National Health Service (NHS) at the end of the study period compared with physicians (53.3% versus 17.7%); however, similar percentages of physicians and NPC had worked for over 15 years in the NHS (35.3% versus 33.3%). NPC had more experience seeing patients at the HIV clinics, with more than twice as many NPC having had over 1500 clinical consults compared with physicians (53.3% versus 18.9%). In addition, NPC averaged nearly twice as many consults per day (9.4 versus 5.7) at the HIV clinics (data not shown).

Study participants

A total of 5892 patients, or 84.7% of all adults who initiated ART, met the inclusion criteria for the study and were considered in analysis. NPC were the initial provider for 4093 (69.5%) study patients, whereas physicians were the initial provider for 1799 (30.5%) patients. Of the sample, 1391 (23.6%) patients saw multiple providers, of which 548 (39.4%) whose initial provider was a physician but switched to a NPC, 375 (27.0%) whose initial provider was a NPC but switched to a physician, and 468 (33.6%) who saw a mixture of providers. Patients who transferred from a NPC to a physician were over three times more likely to have been from the Beira study clinic, were slightly older and were of a higher socioeconomic status (data not shown).

More patients were enrolled in the Beira HIV clinic than Chimoio (55.0% versus 45.0%). No differences were found between patients by provider cadre with regard to the patient's CD4 cell count at clinic enrollment, average age, average years of education or sex (Table 3). Patients whose initial provider was a NPC were more likely to be enrolled in the Beira HIV clinic and a higher percentage lived 5–10 km from the study clinic. Patients whose

initial provider was a physician were of higher socioeconomic status than those seen primarily by a NPC.

Overall, 4002 (67.9%) study patients were alive and on ART at the study clinics at the conclusion of data collection. Of the remaining patients, 381 (6.5%) were transferred to another clinic, 690 (11.7%) were lost to follow-up and 819 (13.9%) died. The proportion of study patients surviving and on ART at the clinics at 12 and 24 months was 74.4% [95% confidence interval (CI) 73.2–75.6%] and 69.5% (68.0–70.9%), respectively.

Quality of HIV care by provider type

After controlling for relevant covariates, NPC had similar or statistically better performance measures as physicians for all five quality measures (Table 4). Although CD4 cell count levels were monitored in the minority of patients, those whose initial provider was a NPC were 12–13% more likely to have CD4 cell monitoring during the year after ART initiation. Independent of provider type, the large majority of patients were seen by clinicians during three of the four quarters after initiating ART. Patients with a NPC as their initial provider had similar adherence to antiretroviral medicines (78.9% versus 77.0%), and were somewhat less likely to have been lost to follow-up when compared with those with a physician as their initial provider (11.4% versus 12.5%). Patients with a NPC as their initial provider were also less likely to have died when compared with those who had a physician as their initial provider [hazard ratio (HR) 0.91, 0.79<HR<1.06; data not shown].

In a subanalysis among study patients whose initial provider was a physician, comparable quality of care outcomes were found for patients initially seen by specialized and general physicians (Table 5). Patients whose initial provider was a generalist were 12% less likely to have a CD4 cell count 90–210 days after ART initiation, although little difference was found in CD4 cell count monitoring 330–390 days after ART initiation. The majority of patients of both provider groups were seen in clinic during three of four quarters after initiating ART and had similarly high levels of adherence to anti-retroviral medicines. Patients with a specialized physician as their initial provider were slightly more likely to have been lost to follow-up from care.

Discussion

In this evaluation of the quality of HIV care provided by NPC and physicians, 69.5% of patients on ART had a NPC as their initial provider. The performance of NPC was similar to or better than that of physicians for the five measures of quality of HIV care that we employed. A large majority of patients in this study adhered well to care, including frequent clinical visits in the first year and high antiretroviral drug adherence in the first 6 months after initiating ART. A relatively low percentage of study patients, however, had their CD4 cell count monitored in the first year after ART initiation (41.9% in the first 90–210 days and 20.4% in the first 330–390 days).

The principal limitation of this study is the non-random assignment of provider type. One possible explanation for the observed differences in HIV care quality is that patients seen by NPC were different from those seen by physicians. Our data, however, do not suggest this. Patients seen by NPC were of lower socioeconomic status, had less education, and lived farther from the clinic than those seen by physicians – factors associated with poorer quality of care outcomes in previous studies [39–41]. In addition, patients seen by physicians and NPC did not differ in terms of CD4 cell count at clinic enrollment, consistent with the conclusion that provider assignment was based on provider availability and not immunological status. Nonetheless, although measured patient characteristics were adjusted for in multivariate analysis, it is possible that unmeasured patient factors (including poorly

diagnosed or documented clinical conditions) were associated with both provider assignment and quality of care measures.

A second limitation in this study is that we were unable to discern the motivation for patient transfers between clinician cadres, and it may be that patients changed providers from NPC to physicians as a result of clinical conditions that surpassed the technical competencies of the NPC providers. Of the 23.6% of patients who saw multiple providers, however, fewer switched from a NPC to a physician (27.0%) than from a physician to a NPC (39.4%), indicating that providers switched more frequently in the direction of referral of stable patients to a NPC rather than a complicated patient to a physician.

An additional limitation is the generalizability of the study results. The study clinics were chosen based on the availability of favourable study conditions, including well managed data sources, and are not a representative sample of HIV clinics in Mozambique. The number of providers was relatively small, and may not be representative of providers in general in terms of the HIV care they deliver. As a result, care should be taken when generalizing these findings to health settings beyond the study clinics.

Despite its limitations, this study is the first of its kind in resource-limited settings, and provides results that are relevant for other countries rapidly expanding ART. The observational design is stronger than cross-sectional assessments that have previously been reported, and the large cohort of patients on ART provided adequate power for our analyses. In addition, the reliance on process measures reflecting international HIV care norms provides interpretable, practical results. Finally, study outcomes, including both process and patient-level outcomes, are well captured in the clinic database, strengthening the validity of study findings.

In this study, the utilization of NPC for HIV care was three times that found in previous research from industrialized healthcare settings, showing a high reliance on NPC for HIV care, including ART. The overall quality of HIV care at the study clinics was similar to that found in other resource-constrained countries expanding ART services, including patient retention and survival [42,43]. The results are consistent with those found in the literature on NPC care quality from industrialized countries, which has found similar or better quality of care measures for NPC compared with physicians for numerous conditions, including HIV.

One potential explanation for the similarity in the process measures is that they reflect a standardized approach to HIV care that is continually reinforced via training and supervision, and the emphasis on following protocols may have led to similar process outcomes for both cadres. Another potential explanation is that NPC provide a continuous, daily presence in the clinic, which has been shown to impact HIV care quality in other studies [44,45]. This stability may reinforce relationships with other clinic staff (nurses, pharmacists, social workers, receptionists and other support staff), and the team-based approach may facilitate communication and attention to individual patient needs. Furthermore, because of their continuous presence and longer hours in the clinics, NPC may have more time to spend with patients, which could result in a stronger rapport, better understanding of individual patient problems and more effective adherence support. Notably, the frequency of clinical visits during the first year after ART initiation was high for patients of both provider cadres, indicating that the differences in other quality of care outcomes is probably not a result of the frequency of patient/provider interaction but other aspects of this interaction or provider characteristics.

Mozambique's HIV care approach has shifted away from fewer large, specialized HIV clinics to many smaller clinics where HIV care is integrated into routine clinical services. Policymakers and health system managers would benefit from research focusing on clinic-

level factors influencing HIV care quality relevant to smaller clinics where there may be only one clinician. Future research should endeavour to understand the interface between facility staff, the intraclinic management approach, and the importance of patient volume on HIV care quality.

Conclusion

This study of nearly 6000 patients initiating ART during the first 40 months of the Mozambique national ART programme found a similar or better quality of HIV care provided by NPC compared with physicians. These results highlight the key role that NPC play in driving ART scale-up, and argue for using all relevant clinical staff to meet the clinical demands in countries with a high HIV burden. The results also underscore the importance of considering NPC training and supervision needs when developing guidelines and regulations for HIV care. A low percentage of patients had CD4 cell counts monitored in the first year after initiating ART, suggesting the presence of general clinic-level barriers that could be improved through supportive approaches, including supervision tools, in-service training programmes and job aids. Furthermore, these results highlight the important role NPC could play in meeting the overall clinical needs of the Mozambique health system.

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Table 1

Characteristics of study clinics.

	Beira	Chimoio	Total
Mean number of adults initiating ART per month ^a	94	80	174
Observed staffing patterns			
Observed physician FTE	1.3	0.5	1.8
Observed NPC FTE	1.4	2.5	3.9
Total observed FTE	2.7	3.0	5.7
Mean number of clinical consults per month	1110	551	1661
Mean number of clinical consults per month with physicians	505 (45.5%)	234 (42.5%)	739 (44.5%)
Mean number of clinical consults per month with NPC	606 (54.6%)	317 (57.5%)	923 (55.6%)

ART, Antiretroviral therapy; FTE, full-time equivalent; NPC, non-physician clinician.

^aDefined as patients more than 15 years of age.

Table 2

Characteristics of study providers.

	Physician (N =37)		NPC (N =15)	
	<i>N</i>	%	<i>N</i>	%
Provider sex				
Male	28	75.7	12	80.0
Female	9	24.3	3	20.0
Training detail				
General physician	20	54.1	NA	
Specialized physician	17	45.9	NA	
Provider age (years)				
<35	4	11.8	7	46.7
35–44	23	67.7	2	13.3
>44	7	20.6	6	40.0
Days of HIV training				
<16	9	26.5	7	46.7
16–29	9	26.5	6	40.0
>29	16	47.1	2	13.3
Years of service				
<11	6	17.7	8	53.3
11–15	16	47.1	2	13.3
>15	12	35.3	5	33.3
HIV patient caseload (consults)				
<500	18	48.7	4	26.7
500–1500	12	32.4	3	20.0
>1500	7	18.9	8	53.3

NPC, Non-physician clinician.

Table 3

Study patient characteristics by provider type.

	Physician		NPC	
	<i>N</i>	%	<i>N</i>	%
Study patients	1799	30.5	4093	69.5
Study clinic				
Chimoio	981	54.5	1671	40.8
Beira	818	45.5	2422	59.2
Sex				
Male	808	44.9	1800	44.0
Female	991	55.1	2293	56.0
Distance of residence from clinic (km)				
<5	1175	65.3	2495	61.0
5–10	391	21.7	1175	28.7
>10	233	13.0	423	10.3
Socioeconomic status				
Low	986	55.8	2409	59.5
Middle	339	19.2	798	19.7
High	443	25.1	843	20.8
	Mean (SD)		Mean (SD)	
CD4 cell count at enrollment	156.5 (115.6)		151.9 (113.9)	
Age, years	36.1 (9.9)		35.9 (9.8)	
Years of education	6.7 (3.5)		6.3 (3.4)	

NPC, Non-physician clinician.

Table 4

HIV care quality measures by provider type.

	Physician		NPC		ARR ^a	95% CI
	N	%	N	%		
CD4 cell count 90–210 days post-ART initiation (N=4071)	496	37.5	1210	44.0	1.13	1.04–1.23
CD4 cell count 330–390 days post-ART initiation (N=3126)	198	18.7	438	21.2	1.12	0.96–1.31
Clinician visit 3 of 4 quarters post-ART initiation (N=3126)	926	87.6	1836	88.7	1.02	1.00–1.05
Optimal 180-day antiretroviral drug adherence (90% antiretroviral drug pick-up) (N=4071)	1019	77.0	2168	78.9	1.05	1.02–1.09
Loss to follow-up (N=5892)	224	12.5	466	11.4	0.86	0.73–1.02

ARR, Adjusted risk ratio or adjusted hazard ratio for loss to follow-up; ART, antiretroviral therapy; CI, confidence interval; NPC, non-physician clinician.

^a Adjusted for clinic and years of patient education. Risk ratios and confidence intervals estimated using generalized linear models for the binomial family, or Cox proportional hazards regression for loss to follow-up.

Table 5

HIV care quality measures by physician specialization.

	<u>General physician</u>		<u>Specialized physician</u>		ARR ^a	95% CI
	N	%	N	%		
CD4 cell count 90–210 days post-ART initiation (N=1323)	320	36.4	176	39.7	0.88	0.74–1.04
CD4 cell count 330–390 days post-ART initiation (N=1057)	131	18.4	67	19.5	0.97	0.71–1.34
Clinician visit 3 of 4 quarters post-ART initiation (N=1057)	631	88.5	295	85.8	1.01	0.97–1.05
Optimal 180-day antiretroviral drug adherence (90% antiretroviral drug pick-up) (N=1323)	689	78.3	330	74.5	1.02	0.94–1.11
Loss to follow-up (N=1799)	137	11.2	87	15.1	1.06	0.75–1.48

ARR, Adjusted risk ratio or adjusted hazard ratio for loss to follow-up; ART, antiretroviral therapy; CI, confidence interval; NPC, non-physician clinician.

^a Adjusted for clinic and years of patient education. Risk ratios and confidence intervals estimated using generalized linear models for the binomial family, or Cox proportional hazards regression for loss to follow-up.