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Retention in Care within 1 Year of Initial HIV Care Visit in a Multisite US Cohort: Who's in and Who's Out?

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Abstract

Biannual attendance at medical visits is an established measure of retention in HIV care. We examined factors associated with attending at least 2 clinic visits at least 90 days apart among HIV-infected, antiretroviral therapy (ART)-naive HIV Outpatient Study participants entering care during 2000 to 2011. Of 1441 patients, 85% were retained in care during the first year of observation. Starting ART during the year was the strongest correlate of retention (adjusted odds ratio [aOR] 6.4, 95% confidence interval [CI] 4.4–9.4). After adjusting for starting ART, publicly insured patients (aOR 0.6, 95% CI 0.4–1.0), and patients with baseline CD4 counts <200 cells/mm^3 (aOR 0.5, 95% CI 0.3–0.9) or missing CD4 counts (aOR 0.3, 95% CI 0.2–0.6) were

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Declaration of Conflicting Interests

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less likely to be retained in care. Although most patients had recommended biannual care visits, some ART-naive individuals may require additional interventions to remain in care. Promptly initiating ART may facilitate engagement in care.

Keywords

retention; antiretroviral adherence; HIV infection

Introduction

Improving retention in HIV care is a key goal of the US National HIV/AIDS strategy.[1] Retention in care improves clinical outcomes such as survival[2,3] and virologic control,[4–6] facilitates appropriate receipt of vaccinations and other health screenings,[7] and also decreases race-/ethnicity-related health care disparities.[8] Various US medical sources have emphasized the importance of retention in HIV care[9–13] and have proposed to measure it by a criterion of at least 2 HIV medical visits during a calendar year, spaced at least 2 to 6 months apart, depending on the specific measure employed.[12–16] Retention in medical care is one of the quality performance measures used by the US HIV/AIDS Bureau within the Health Resources and Services Administration (HRSA) for any site they support that provides HIV services.[16] An HIV-infected patient must attend at least 2 appropriately spaced medical visits within a year to meet the retention criterion. Unfortunately, it is estimated that among persons aware of their HIV status in various US populations, at least 50% may not be retained in care.[2,17–23] In a national study based on HIV surveillance data and utilizing laboratory data as proxy measurements for retention (at least 2 CD4 counts or plasma HIV RNA viral load tests at least 3 months apart within a year), only 45% of HIV-infected patients were considered retained in HIV care.[24] Factors associated with increased risk of not attending a minimum of 2 medical visits per year have included younger age, black or African American (hereinafter referred to as black) and Hispanic/Latino race/ethnicity, and concomitant drug or alcohol use.[17,22,25–27]

Current US guidelines recommend offering HIV treatment to all patients,[28] an important contrast to previous guidance just a few years ago that recommended assessing readiness for therapy and waiting until the CD4 count falls to 350 cells/mm.[29] In older guidance, a few exceptions existed, such as offering treatment to persons with ongoing high-risk behavior regardless of the CD4 count. This evolution of the treatment paradigm reflects new knowledge that earlier antiretroviral therapy (ART) not only appears to improve individual outcomes[3,6,20,30–33] but also profoundly reduces HIV transmission and new infections at the population level.[28,34] Possible sociodemographic disparities associated with starting combination ART (cART) may be reduced under the current guidance that uniformly recommends cART for all who are ready. In the period of this analysis, which spanned 2000 to 2011, we hypothesized that factors such as baseline CD4 count, baseline plasma HIV RNA viral load, insurance status, and HIV risk behaviors (eg, injection drug use) may have played a more prominent role in who started cART and the frequency of clinical and virologic monitoring they subsequently received. We also hypothesized that starting ART may be associated with better retention in care, in part because of the long-standing

recommendations for frequent HIV viral load monitoring in patients starting ART (4–8 weeks until viral load suppression, then 3–6 months thereafter).[28,29] In this context, we sought to describe the rates of, and factors associated with, biannual clinic attendance among ART-naive HIV Outpatient Study (HOPS) participants entering HOPS care during 2000 to 2011.

Methods

The HIV Outpatient Study

The HOPS is an ongoing prospective observational cohort study of HIV-infected patients seen at public and private HIV clinics in the United States. This analysis included patients seen at 8 clinics located in 6 cities: Tampa, Florida; Washington, DC; Denver, Colorado; Chicago, Illinois; Stony Brook, New York; and Philadelphia, Pennsylvania. The participating physicians routinely care for hundreds of HIV-infected patients and have extensive experience with HIV care and some of these providers also provide primary care. The HOPS does not have scheduled visits but instead participants are recruited, typically shortly after initiating their care at the clinic, and voluntarily consent to abstraction of their medical records without any financial compensation. Data are abstracted in real time from patient medical records and entered directly into an electronic database by trained abstractors. Abstracted information includes basic demographics, risk factors for HIV infection, insurance status, diagnoses, treatments, laboratory values, and type of medical encounters. The data are compiled centrally and undergo quality checks before analyses. Since its inception, the HOPS protocol has been reviewed annually and approved by the Centers for Disease Control and Prevention (Atlanta, Georgia), Cerner Corporation (Vienna, Virginia), and each participating local site's institutional review boards. The study protocol conforms to the guidelines of the US Department of Health and Human Services for the protection of human participants in research.

Study Population

This cross-sectional analysis of HOPS patient encounters during 2000 to 2012 was conducted using the HOPS data set updated as of June 30, 2013. To be included in the analyses, patients had to be ART naive and have had their first visit with a HOPS medical provider termed here the "index visit" or "index date," between January 1, 2000, and March 31, 2011. Patients also had to be alive for at least 90 days after the index date so that their visit frequency could be described, and they had an opportunity to have at least one more adequately spaced visit within the year after the index date (through March 31, 2012), consistent with HRSA and the Institute of Medicine (IOM) indicators for retention in HIV care.[13,16] A small fraction of HOPS patients begin their initial ART in the context of clinical trials, which have predetermined visit frequencies per protocol. We decided to exclude from analyses patients who were already enrolled in a clinical trial as of the index date but included those who enrolled in a trial after the index date and then computed retention levels with and without their data.

Variable Definitions

Retention in care was defined as having ≥1 provider visit within 90 to 365 days after the initial (index) visit with the HOPS provider, consistent with HRSA and IOM biannual visit definition.[13,16] Patients without a second provider visit in this time frame were designated as not being retained in care; some of these patients were seen again in HOPS care >365 days after the index visit. For purposes of defining retention in care, the eligible visits included the following types: routine office visits, initial visits, event- or symptom-driven visits, and return to active status. The following visit types were excluded from the definition: laboratory-only visits, hospital admissions or emergency room visits, telephone calls, pharmacy encounters, or outpatient surgical procedures. The baseline laboratory markers were CD4 count and plasma HIV RNA viral load measured closest to and within 3 months before or after the index date.

Baseline CD4 count and HIV viral load were those closest to and measured either before or up to 90 days after the index date. Insurance payer was defined as the type in use as of the index date: “private” included commercial private insurance, such as preferred provider organization, health maintenance organization, or point of service, whereas “public” included Medicare and Medicaid. We classified patients who had Ryan White coverage separately from those with private or public insurance.

Statistical Analyses

Continuous variables (ie, age, CD4 count, and plasma HIV RNA viral load) were categorized for analysis using standard clinically based cut points. We used chi-square tests and logistic regression to identify demographic and clinical factors univariately associated with being retained in care within the 1-year period of HOPS enrollment. To explore the temporal sequence between ART initiation and retention, we examined the patterns of patients’ visits in relation to starting ART. We then constructed multivariable logistic regression models that included variables significantly (2-sided P value < .2) associated with retention, all of which were kept in the final multivariable models regardless of the statistical significance of their associations in these adjusted models. Because starting ART during the year was the strongest correlate of retention in univariate analyses, and inclusion of “starting ART” variable markedly altered the association between baseline CD4 count and retention in the regression models, we explored these associations in stratified tables and built multivariable models for retention with and without the “starting ART” variable. Likewise, when further exploring the drivers of ART initiation in our population, we constructed multivariable logistic regression models for the outcome of “starting ART” with and without the “retained in care” variable in the model. Results from the logistic regression models are reported as odds ratios (ORs) with associated 95% confidence intervals (CIs) for the univariate analysis and as adjusted ORs (aORs) for the multivariable models. Guided by the results from exploratory analyses, we did not simultaneously include HIV viral load measurements and CD4 counts in the regression models because of collinearity between missing baseline HIV viral load and missing baseline CD4 count. For the same collinearity reason, only the starting ART variable, but not starting clinical trial variable, was included in the models. All analyses were performed using SAS 9.3 (Cary, North Carolina).

Results

Among the 1441 patients meeting study inclusion criteria, 1232 (85%) were retained in HIV care during the first year of HOPS observation (Table 1). Of the 209 (15%) patients who were not retained, 120 (57%) were lost to follow-up or transferred their care to a non-HOPS provider, 9 (4%) died after the first 90 days, and 80 (38%) returned to HOPS clinic >365 days after the index visit. Across the 8 clinic sites analyzed, the percentage of patients who were retained in care during the first year of HOPS observation ranged from 76 to 96. The median time from HIV diagnosis to index date was 1.3 months (interquartile range 0.5–7.1) for all patients; it was 1.1 months (0.5–5.7) for those subsequently retained and 2.7 months (0.7–23.8) for those subsequently not retained ($P < .001$).

In univariate analyses, the distributions of the characteristics of patients who were retained in care versus those not retained in care were not statistically different by age and sex, but the distributions differed by race/ethnicity, HIV transmission group, insurance payer, index year, and a number of HIV disease-related factors (Table 1, middle columns). Among the key findings (Table 1, rightmost 2 columns), the percentages retained in care tended to be higher among non-Hispanic white than non-Hispanic black or Hispanic patients and higher among gay, bisexual, and other men who have sex with men (collectively referred to as MSM) than injection drug users (IDUs) or heterosexuals. Compared with other counterparts, the percentage retained in care was lower for persons with public insurance and those studied in the earlier calendar years (Table 1). Persons with missing baseline CD4 counts or missing baseline HIV viral loads had markedly lower levels of retention. Retention was significantly higher among the 3% of patients who started a clinical trial than those who did not (98% versus 85%) and among the 64% of patients who initiated ART during the first year of HOPS observation than those who did not (93% versus 72%; Table 1).

In univariate logistic regression analyses (Table 2), the following factors were associated with lower odds of being retained in care in the first year of HOPS observation: nonwhite race, IDU risk group for HIV infection (versus referent MSM risk group), having public insurance (versus referent private insurance), and having a missing CD4 count (versus referent CD4 count >350 cell/mm^3) or a missing HIV viral load (versus referent viral load <1000 copies/mL) at baseline. Conversely, patients whose index date was in 2004 to 2008 (versus calendar years 2000–2003 referent group) and patients who initiated ART during the first year of HOPS observation had higher odds of being retained in care.

In the first multivariable logistic regression model, which controlled for ART initiation, patients with public insurance (versus referent private insurance), with CD4 count <200 cells/mm^3 or no baseline CD4 count (versus referent CD4 count > 350 cells/mm^3) were significantly less likely to be retained in care (Table 2, multivariable model A). Antiretroviral therapy initiation was the strongest factor associated with retention in care in both univariate and multivariable analyses (aOR 6.4, 95% CI 4.4–9.4).

When ART initiation was omitted from the multivariable logistic regression analysis, patients of nonwhite race/ethnicity (versus white, non-Hispanic race/ethnicity), those with IDU HIV transmission risk group (versus referent MSM risk group), and those who had no

baseline CD4 count measured (versus referent CD4 count > 350 cells/mm^3) were significantly less likely to be retained in care (Table 2, multivariable model B). When not controlling for ART use, patients with lower CD4 count had greater adjusted odds of being retained in care, although this was not statistically significant.

During the first year of HOPS observation, 926 (64%) of the 1441 patients were prescribed ART. Of these patients, 248 (27%) had baseline CD4 counts >350 cells/mm^3 and 111 (12%) had CD4 counts >500 cells/mm^3. There were 100 (7%) patients with baseline CD4 count <350 cells/mm^3, who did not initiate ART during the year, which may have been related to their nonattendance in care. Within the strata of baseline CD4 count of <200, 200 to 350, and >350 cells/mm^3, starting ART was positively associated with being retained in care at all CD4 count levels: univariate OR (95% CI) equal to 12.3 (5.7–26.2), 8.1 (3.4–19.4), and 3.4 (1.9–6.5), respectively.

Regarding the pattern of visits and sequence of events for 864 patients who both started ART and were retained in care, 650 (75%) started ART prior to meeting the definition for being retained in care, 47 (5%) started ART on the same day they met the definition for being retained in care, and 167 (19%) started ART after achieving the retention outcome.

In multivariable logistic regression analyses of factors associated with ART initiation during 2000 to 2011, in addition to being retained in care, having a lower CD4 count (CD4 count < 200 cells/mm^3 and CD4 count between 200 and 350 cells/mm^3 versus CD4 > 350 cells/mm^3) was independently associated with greater odds of ART initiation, whereas nonwhite race/ethnicity was associated with lower odds of initiating ART during the year (aOR 0.6, 95% CI 0.4–0.8; Table 3, multivariable model A). Results from the alternative logistic model without the ART initiation variable (Table 3, multivariable model B) were similar.

In further sensitivity analyses (not presented in tables), we analyzed separately and compared the predictors of retention for patients entering care in the first period (2000–2003), second period (2004–2008), and third period (2009–2011). The percentage of patients missing baseline CD4 counts was higher in the first and third than second period: 84 (14%) in the first, 38 (6%) in the second, and 20 (9%) in the third ($P < .001$). The percentages of patients who started ART during the first year of observation were 60 (n = 359) in the first period, 66 (n = 411) in the second period, and 71 (n = 156) in the third ($P = .01$) period. In multivariable models, having a baseline CD4 count <200 cells/mm^3 (aOR 0.5, 95% CI 0.2–1.0) or missing baseline CD4 count (aOR 0.3, 95% CI 0.2–0.6; versus referent CD4 count >350 cells/mm^3) was significantly associated with lower odds of retention in care, while ART initiation was associated with greater odds of retention in care in the first period (aOR 7.7, 95% CI 4.2–14.2). The multivariable predictors significantly associated with having been retained in care in the second period included public insurance (aOR 0.4, 95% CI 0.2–1.0), having a missing baseline CD4 count (aOR 0.3, 95% CI 0.1–0.7), and starting ART (aOR 7.0, 95% CI 3.5–13.7). Predictors significantly associated with retention in care in the third period included having public insurance (aOR 0.3, 95% CI 0.1–0.9) and starting ART (aOR 3.8, 95% CI 1.6–9.2).

Discussion

Among ART-naive patients who initiated care in HOPS clinic sites during 2000 to 2011, 85% achieved the minimum standard for retention (attended ≥1 visit within 90-365 days after the initial [index] visit) during their first calendar year of observation in the study. Initiating ART was the strongest correlate of being retained in HIV care. Although the causal pathway is uncertain (patients starting ART may be more likely to return for visits and patients attending care may have more opportunity for timely ART initiation), the most frequent scenario in the HOPS was first starting ART and then meeting the 2 visit criterion for retention in care.

The 85% retention in care finding in this study exceeds percentages from some published reports of US patients diagnosed with HIV infection who have accessed medical care, although the data collection methods, duration of observation, and the extent of ART use within patient populations differ across these studies. [6,15,19,20,22–24,35] In our study, unadjusted retention rates were generally lower for patients of nonwhite race/ethnicity, with IDU as an HIV transmission risk factor, with public insurance, enrolled earlier in HOPS, and with missing baseline CD4 counts and/or viral loads. After controlling for starting ART during the year and other factors, public insurance was still a risk factor, but nonwhite race/ethnicity and IDU transmission risk were no longer significantly associated with nonretention. Other US studies have found that patients who are often vulnerable to HIV/AIDS due to pervasive stigma, socioeconomic distress, or poor access to or utilization of health care[25,36–38] are less likely to successfully link to or remain engaged in HIV care.[4,17,39] Persons with an HIV transmission risk of IDU also have poorer adherence and experience poorer outcomes.[40–42] Retention rates improve when drug treatment sites provide, or interventions are coupled with, HIV-related care, although this model is the exception rather than the norm in medical settings.[43–47]

The HRSA performance standards for adequate care include both biannual medical visits and measurements of CD4 count and plasma HIV RNA viral loads.[16] Among HOPS patients with inadequate retention in their first year of care, 24% were missing a baseline CD4 count and 32% were missing a baseline plasma HIV RNA viral load. For an ART-naive population, this lack of clinical data is concerning and unexplained. Two sites within the HOPS network receive Ryan White CARE Act funding to provide laboratory testing for uninsured or underinsured individuals. With 50% of this cohort presenting to care with CD4 counts <350 cells/mm^3, it is very likely patients missing baseline laboratory evaluations may miss the opportunity to initiate ART. Even after we had conducted an extensive supplemental review of available older medical records, there remained a small fraction of patients with missing CD4 counts and plasma HIV RNA viral load measurements; these patients were clustered at large public university sites and their number decreased in later calendar years. Although standard clinical practice for new HIV-infected patients presenting for care includes laboratory testing at entry, there appears to be room for improvement in this area that could potentially improve retention. Notably, 38% of the patients who did not meet our retention standard returned to care over 1 year after the baseline date. This delay in establishing care has been noted in other analyses and has been variably attributed to denial of HIV infection after diagnosis, incarceration, active substance use, and mental illness.[48–51]

The strongest correlate of retention during the first year of care was the initiation of ART and this association was present even among patients with baseline CD4 counts >350 cells/mm^3. Overall, 93% of patients who started ART in our study were retained in care, and the adjusted odds of retention were 6 times as great for patients prescribed ART as for those patients who were not prescribed ART. The retained patients had a median of 7 visits during the year, and among the subset that also started ART, 75% did so before achieving the second visit and meeting retention outcome, giving credence to the notion that starting ART facilitated retention, possibly due to the need for more frequent follow-up provider contact and laboratory monitoring. The emerging paradigm of "test and treat" to reduce HIV transmission and improve individual clinical outcomes for both HIV and non-HIV complications is gaining hold.[6,19,28,52] The findings from our analysis suggest that universal early initiation of ART may well improve retention during the first year in care.

Our study provides a variation from other US-based analyses that examined establishing care or visit adherence in the first few months to years in HIV care. In the HIV Research Network, 22% of patients never established HIV care (defined as having an out-patient visit >6 months after initial enrollment), an estimate somewhat higher than ours.[21] In that study, rates of establishment in care differed by race/ethnicity and insurance status, but this analysis was not restricted to ARV-naive patients and did not explicitly consider initiation of cART use.[21] Torian and Wiewel examined HIV laboratory surveillance data as a proxy for clinic visits and found that 77% of HIV-infected patients in New York city made an initial HIV care visit within 6 months of their diagnosis, 94%of these made at least 1 subsequent visit, but only 45% met their definition of adequate retention (≥1 visit every 6 months) during their first 4 years of care.[22] Ineligibility for ART at the time was also associated with lower visit frequency in these analyses. The clinical consequences of early nonretention in HIV care were highlighted by Mugavero and colleagues who found that at 2 university clinics patients who had at least 1 "no show" visit during the 2 years after initiation of care experienced a longer time to virologic suppression.[6] Finally, our findings corroborate those from a recent US-based multisite study, which found that 84% of HIV-infected patients were engaged in continuous care in 2010 (defined as ≥2 visits at least 3 months apart) and that engagement in continuous care was the single factor most strongly associated with ART use and virologic suppression.[35]

Although patients with lower CD4 counts were more likely to initiate ART, which was associated with greater likelihood of retention, paradoxically we also observed that when we controlled for ART initiation such patients were less likely to be retained in care during the first year (Table 2, multivariable model A). We expected such patients would be more likely to be retained since they have been prioritized for treatment initiation and can require more frequent visits to address opportunistic illnesses and comorbidities. However, we have observed in prior HOPS work that persons diagnosed with HIV infection at a CD4 count <200 cells/mm^3 were more likely to have been heterosexual or IDU, to be of age ≥35 years at diagnosis, and to be of nonwhite race/ethnicity.[53] These sociodemographic characteristics may correlate with underlying risk factors for nonretention such as incarceration, homelessness, mental illness, active drug use, not disclosing HIV status, or patient refusal of ART offer and lack of readiness to start lifelong therapy.[4,25,37,41,47] Our data caution that prescribing ART will not necessarily improve retention for everyone, particularly for

persons with lower CD4 counts who may face myriad other socioeconomic and behavioral challenges that may need to be addressed to achieve successful retention.

Our findings are subject to some additional caveats. It is difficult to measure the effects of provider practices and adherence to current US antiretroviral treatment guidelines on retention in our study because the recommended CD4 count at which to initiate ART shifted during our analysis period.[28,29,52] Although inclusion of patients who enrolled in clinical trials might result in overestimates of retention, only 3% of eligible patients started a clinical trial in the course of the year, and the overall retention rate was similar whether or not they were included (85%). Some HOPS clinics, particularly those serving indigent populations, have employed strategies[9,11,54] to help patients remain in continuous care (eg, assistance by patient navigators or case managers, referrals to ancillary services such as mental health and substance abuse, and reminder phone calls), but the use of these interventions was not systematically captured in the HOPS database and could not be evaluated in this study.

Engagement into care is a complex process that requires the successful integration of personal and system-level factors.[11,37,54–56] The federally funded Ryan White CARE Act system of care has incorporated medical and ancillary services into its programs to maximize retention in care. For recipients of Ryan White CARE Act funding, there are standardized performance-based quality measures tied to ongoing site funding designed to incentivize providers to deliver optimal care for US HIV-infected individuals. Our analysis, which included data from 2 Ryan White CARE Act-funded practices, demonstrates that successful retention in care is possible in a heterogeneous cohort. However, the deficits in retention for impoverished minorities and drug users are familiar themes. The emerging model of offering early ART to all patients may be an effective strategy for engagement into care, particularly if coupled with a broader agenda that addresses underlying individual and societal causes of disparities in HIV morbidity, care, and treatment in the United States.[57]

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Table 1

Demographic and Clinical Characteristics Associated with Retention in Care (≥1 visit with a provider 90-365 days after the first HOPS visit) among ART-Naive Patients in the HOPS, 2000 to 2011.[a]

	Total Number (N = 1441)		Retained in Care (N =1232)		Not Retained in Care (N =209)		Retained in Care within Each Subgroup	
Characteristic	**N**	**col %**	**n**	**col %**	**n**	**col %**	**row %**	***P* Value**
Age, years								.18
≤29	329	22.8	285	23.1	44	21.1	86.6	
30–39	496	34.4	411	33.4	85	40.7	82.9	
40–49	363	29.2	363	29.5	58	27.8	86.2	
≥50	195	13.5	173	14.0	22	10.5	88.7	
Sex								.97
Male	1070	74.3	915	74.3	155	74.2	85.5	
Female	371	23.8	317	25.7	54	25.8	85.4	
Race/ethnicity								<.01
White, non-Hispanic	560	38.9	502	40.8	58	27.8	89.7	
Black, non-Hispanic	632	43.9	521	42.3	111	53.1	82.4	
Hispanic	191	13.3	157	12.7	34	16.3	82.2	
Other/unknown	58	4.0	52	4.2	6	2.9	89.6	
HIV transmission risk								<.01
Heterosexual	523	36.3	440	35.7	83	39.7	84.1	
IDU	94	6.5	68	5.5	26	12.4	72.3	
MSM	724	50.2	637	51.7	87	41.6	88.0	
Other/unknown	100	6.9	87	7.1	13	6.2	87.0	
Insurance payer								.003
Private	767	53.2	676	54.9	91	43.5	88.1	
Public	441	30.6	354	28.7	87	41.6	80.3	
Ryan White	40	2.8	34	2.8	6	2.9	85.0	
Self-pay/none	101	7.0	91	7.4	10	4.8	90.1	
Other	92	6.4	77	6.3	15	7.2	83.7	
Index year								.01
2000–2003	595	41.3	489	39.7	106	50.7	82.2	

	Total Number (N = 1441)		Retained in Care (N =1232)		Not Retained in Care (N =209)		Retained in Care within Each Subgroup	
Characteristic	**N**	**col %**	**n**	**col %**	**n**	**col %**	**row %**	***P* Value**
2004–2008	626	43.4	555	45.1	71	34	88.7	
2009–2011	220	15.3	188	15.3	32	15.3	85.5	
Baseline CD4 count, cells/mm^3								<.01
<200	461	31.3	403	32.7	48	23.0	89.4	
200–350	275	19.1	243	19.7	32	15.3	88.4	
>350	573	39.8	495	40.2	78	37.3	86.4	
None	142	9.9	91	7.4	51	24.4	64.1	
Baseline viral load, copies/mL								<.01
<1000	169	11.7	147	11.9	22	10.5	87.0	
1000–29 999	395	27.4	342	27.8	53	25.4	86.6	
30 000–100 000	309	21.4	279	22.7	30	14.4	90.3	
>100 000	384	26.7	346	28.1	38	18.2	90.1	
None	184	12.8	118	9.6	66	31.6	64.1	
Started clinical trial								.02
Yes	43	3.0	42	3.4	1	0.5	97.7	
No	1398	97.0	1190	96.6	208	99.5	85.1	
Started ART in index year								<.01
No	515	35.7	368	29.9	147	70.3	71.5	
Yes	926	64.3	864	70.1	62	29.7	93.3	
Number during index year, median (IQR)								
Visits	6 (4–9)		7 (5–10)		2 (1–2)			<.01
HIV viral loads	3 (2–5)		4 (2–5)		1 (0–1)			<.01
CD4 counts	3 (2–5)		4 (3–5)		1 (0–1)			<.01

Abbreviations: ART, antiretroviral therapy; col, column; IDU, injection drug user; HOPS, HIV Outpatient Study; IQR, interquartile range; MSM, men having sex with men.

[a] N = 1441.

Table 2

Logistic Regression Analyses of Factors Associated with Retention in Care During the First Year of Observation among ART-Naive Patients in the HOPS, 2000 to 2011.[a,b]

	Univariate Analysis		Multivariable Model A		Multivariable Model B	
Characteristic at Baseline	**OR (95% CI)**	***P* Value**	**aOR (95% CI)**	***P* Value**	**aOR (95% CI)**	***P* Value**
Age, years						
≤29	1.0 (0.7–1.6)	.87	1.1 (0.7–1.7)	.83	1.0 (0.6–1.5)	.86
30–39	0.8 (0.5–1.1)	.16	0.8 (0.5–1.2)	.22	0.7 (0.5–1.1)	.13
40–49	Referent		Referent		Referent	
≥50	1.3 (0.7–2.1)	.39	1.3 (0.8–2.4)	.30	1.3 (0.7–2.2)	.42
Sex						
Male	Referent					
Female	1.0 (0.7–1.4)	.97				
Race/ethnicity						
White, non-Hispanic	Referent		Referent		Referent	
Nonwhite	0.6 (0.4–0.8)	<.001	0.8 (0.5–1.2)	.33	0.7 (0.5–1.0)	.049
HIV risk						
Heterosexual	0.7 (0.5–1.0)	.05	1.0 (0.7–1.6)	.98	1.1 (0.7–1.6)	.81
IDU	0.4 (0.2–0.6)	<.001	0.6 (0.3–1.1)	.09	0.5 (0.3–0.9)	.029
MSM	Referent		Referent		Referent	
Other/unknown	0.9 (0.5–1.7)	.78	1.1 (0.5–2.1)	.87	1.1 (0.6–2.2)	.76
Insurance payer						
Private	Referent		Referent		Referent	
Public	0.5 (0.4–0.8)	<.001	0.6 (0.4–1.0)	.031	0.7 (0.5–1.0)	.05
Ryan White	0.8 (0.3–1.9)	.55	0.7 (0.3–2.0)	.56	0.7 (0.3–1.9)	.52
Self-pay/none	1.2 (0.6–2.4)	.56	1.3 (0.6–2.7)	.50	1.3 (0.6–2.6)	.53
Other	0.7 (0.4–1.3)	.22	0.8 (0.4–1.7)	.61	0.8 (0.4–1.6)	.59
Index year						
2000–2003	Referent		Referent		Referent	
2004–2008	1.7 (1.2–2.3)	.001	1.2 (0.9–1.8)	.25	1.4 (1.0–1.9)	.09
2009–2011	1.3 (0.8–2.0)	.27	1.0 (0.6–1.7)	.85	1.1 (0.7–1.8)	.64

	Univariate Analysis		Multivariable Model A		Multivariable Model B	
Characteristic at Baseline	**OR (95% CI)**	***P* Value**	**aOR (95% CI)**	***P* Value**	**aOR (95% CI)**	***P* Value**
Baseline CD4 count, cells/mm^3						
<200	1.3 (0.9–1.9)	.15	0.5 (0.3–0.9)	.012	1.5 (1.0–2.2)	.06
200–350	1.2 (0.8–1.9)	.42	0.6 (0.4–1.0)	.06	1.3 (0.8–2.0)	.29
>350	Referent		Referent		Referent	
None	0.3 (0.2–0.4)	<.001	0.3 (0.2–0.6)	<.001	0.4 (0.2–0.6)	<.001
Baseline viral load, copies/mL						
<1000	Referent					
1000–29 999	1.0 (0.6–1.6)	.90				
30 000–100 000	1.4 (0.8–2.5)	.27				
>100 000	1.4 (0.8–2.4)	.28				
None	0.3 (0.2–0.5)	.001				
Started ART in index year						
No	Referent		Referent			
Yes	5.6 (4.0–7.7)	<.001	6.4 (4.4–9.4)	<.001		

Abbreviations: OR, odds ratio; CI, confidence interval; aOR, adjusted odds ratio; ART, antiretroviral therapy; IDU, injection drug user; MSM, men having sex with men; HOPS, HIV Outpatient Study.

[a] N = 1441.

[b] Multivariable model A included ART initiation, whereas model B did not. Retained in care was defined as having ≥1 visit with a provider 90 to 365 days after the first HOPS visit.

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Table 3

Logistic Regression Analyses of Factors Associated with Starting ART among Baseline ART-Naive Patients in the HOPS, 2000 to 2011.[a,b]

	Univariate Analysis		Multivariable Model A		Multivariable Model B	
Characteristic at Baseline	**OR (95% CI)**	***P* Value**	**aOR (95% CI)**	***P* Value**	**aOR (95% CI)**	***P* Value**
Age, years						
≤29	0.7 (0.5–0.9)	.008	0.7 (0.5–1.0)	.09	0.7 (0.5–1.0)	.09
30–39	0.8 (0.6–1.0)	.09	0.9 (0.6–1.2)	.47	0.8 (0.6–1.2)	.27
40–49	Referent		Referent		Referent	
≥50	0.9 (0.6–1.3)	.46	0.7 (0.4–1.1)	.09	0.8 (0.5–1.1)	.18
Sex						
Male	Referent					
Female	0.9 (0.7–1.2)	.42				
Race/ethnicity						
White, non-Hispanic	Referent		Referent		Referent	
Nonwhite	0.8 (0.7–1.0)	.07	0.6 (0.4–0.8)	.001	0.6 (0.4–0.8)	<.001
HIV risk						
Heterosexual	1.2 (0.9–1.5)	.16	1.1 (0.8–1.6)	.45	1.1 (0.8–1.5)	.58
IDU	0.6 (0.4–0.9)	.023	0.7 (0.4–1.3)	.29	0.6 (0.4–1.1)	.08
MSM	Referent		Referent		Referent	
Other/unknown	1.3 (0.8–2.0)	.26	1.2 (0.7–2.2)	.46	1.2 (0.7–2.1)	.49
Insurance payer						
Private	Referent					
Public	1.0 (0.8–1.3)	.98				
Ryan White	1.3 (0.6–2.6)	.48				
Self-pay/none	0.8 (0.5–1.2)	.23				
Other	1.0 (0.6–1.5)	.94				
Index year						
2000–2003	Referent		Referent		Referent	
2004–2008	1.3 (1.0–1.6)	.05	1.2 (0.9–1.6)	.27	1.2 (0.9–1.6)	.16
2009–2011	1.6 (1.1–2.2)	.006	1.5 (1.0–2.2)	.05	1.5 (1.0–2.2)	.046
Baseline CD4 count, cells/mm^3						

Characteristic at Baseline	Univariate Analysis		Multivariable Model A		Multivariable Model B	
	OR (95% CI)	*P* Value	aOR (95% CI)	*P* Value	aOR (95% CI)	*P* Value
<200	11.8 (8.3–16.8)	<.001	15.2 (10.3–22.3)	<.001	13.2 (9.1–18.9)	<.001
200–350	5.1 (3.7–7.2)	<.001	6.3 (4.4–9.1)	<.001	5.7 (4.0–8.0)	<.001
>350	Referent		Referent		Referent	
None	0.8 (0.5–1.1)	.20	1.3 (0.8–1.9)	.28	0.9 (0.6–1.4)	.71
Baseline viral load, copies/mL						
<1000	Referent					
1000–29 999	0.9 (0.6–1.3)	.55				
30 000–100 000	2.2 (1.5–3.3)	<.001				
>100 000	3.9 (2.6–5.9)	<.001				
None	0.6 (0.4–0.9)	.010				
Retained in care						
No	Referent		Referent			
Yes	5.6 (4.0–7.7)	<.001	6.5 (4.4–9.5)	<.001		

Abbreviations: OR, odds ratio; CI, confidence interval; aOR, adjusted odds ratio; ART, antiretroviral therapy; IDU, injection drug user; MSM, men having sex with men.

[a] N = 1441.

[b] Multivariable model A included “Retained in care,” whereas model B did not.

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