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### Authors

Radwan, Daniel
Cachay, Edward
Falade-Nwulia, Oluwaseun
et al.



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# HCV Screening and Treatment Uptake Among Patients in HIV Care During 2014–2015

**Daniel Radwan, MPH, MBA**[a], **Edward Cachay, MD, MAS**[b], **Oluwaseun Falade-Nwulia, MBBS, MPH**[a], **Richard D. Moore, MD, MHS**[a], **Ryan Westergaard, MD, PhD, MPH**[c], **William Christopher Mathews, MD, MSPH**[b], **Judith Aberg, MD**[d], **Laura Cheever, MD, ScM**[e], **Kelly A. Gebo, MD, MPH**[a], **HIV Research Network**

[a]Johns Hopkins University School of Medicine, Baltimore, MD;

[b]University of California San Diego, San Diego, CA;

[c]University of Wisconsin, Madison, WI;

[d]Icahn School at Mt. Sinai, New York, NY;

[e]Health Resources and Services Administration, Rockville, MD.

## Abstract

**Background:** Despite the high prevalence of hepatitis C virus (HCV) among persons living with HIV (PWH), the prevalence of HCV screening, treatment, and sustained virologic response (SVR) is unknown. This study aims to characterize the continuum of HCV screening and treatment among PWH in HIV care.

**Setting:** Adult patients enrolled at 12 sites of the HIV Research Network located in 3 regions of the United States were included.

**Methods:** We examined the prevalence of HCV screening, HCV coinfection, direct-acting antiretroviral (DAA) treatment, and SVR-12 between 2014 and 2015. Multivariate logistic regression was performed to identify characteristics associated with outcomes, adjusted for site.

**Results:** Among 29,071 PWH (age 18–87, 74.8% male, 44.4% black), 77.9% were screened for HCV antibodies; 94.6% of those screened had a confirmatory HCV RNA viral load test. Among those tested, 61.1% were determined to have chronic HCV. We estimate that only 23.4% of those eligible for DAA were prescribed DAA, and only 17.8% of those eligible evidenced initiating DAA treatment. Those who initiated treatment achieved SVR-12 at a rate of 95.2%. Blacks and people who inject drugs (PWID) were more likely to be screened for HCV than whites or those with heterosexual risk. Persons older than 40 years, whites, Hispanics, and PWID [adjusted odds ratio (AOR) 8.70 (7.74 to 9.78)] were more likely to be coinfected than their counterparts. When examining treatment with DAA, persons older than 50 years, on antiretroviral therapy [AOR 2.27

Correspondence to: Kelly A. Gebo, MD MPH, Johns Hopkins University School of Medicine, Room 435, 1830 East Monument Street, Baltimore, MD 212187 (kgebo@jhmi.edu).

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(1.11 to 4.64)], with HIV-1 RNA <400 [AOR 2.67 (1.71 to 4.18)], and those with higher Fib-4 scores were more likely to be treated with DAA.

**Conclusions:** Although rates of screening for HCV among PWH are high, screening remains far from comprehensive. Rates of SVR were high, consistent with previously published literature. Additional programs to improve screening and make treatment more widely available will help reduce the impact of HCV morbidity among PWH.

### Keywords

HIV; HCV; hepatitis C; DAA; continuum of care

## INTRODUCTION

Hepatitis C virus (HCV) is the most common bloodborne pathogen in the United States. Approximately 2.7 million Americans are infected with HCV.[1] Because of shared transmission routes, it is estimated that HCV coinfection among Americans infected with HIV is 15–30 times more prevalent than among the general population.[2,3] Liver-related deaths among persons living with HIV (PWH) have markedly increased since the introduction of combination antiretroviral therapy (ART) in 1997[4] and have become a leading cause of death among PWH.[5] Research suggests that the presence of HIV, regardless of ART treatment, advances the progression of the HCV and is associated with worse clinical outcomes.[6–10]

The introduction of direct-acting antiretroviral (DAA) treatment for HCV offers great potential for eliminating HCV, especially among persons with HIV. DAAs, introduced to US markets in 2014, have an excellent safety profile, are highly efficacious, and require a short course of treatment to achieve sustained virologic response (SVR).[11] Data from clinical trials demonstrate that DAA-based therapy is as effective in HIV/ HCV-coinfected patients as in those with HCV monoinfection.[12]

Before the introduction of DAA therapy, it was estimated that only one percent of HIV/ HCV-coinfected patients were successfully treated and cured of HCV.[13] Historically, barriers to treatment included low referral rates, low rates of treatment eligibility, and various patient- and provider-level biases.[14] Despite the high prevalence of HIV/ HCV coinfection and the availability, safety, and efficacy of DAA drugs, there are limited data on the status of the HCV care continuum among HIV-coinfected patients spanning HCV screening, treatment uptake, and cure rates in large cohorts in the oral DAA era.

The objective of this study is to characterize the continuum of HCV screening and treatment among PWH during the first 2 years of DAA availability [January 1, 2014-December 31, 2015: first, to describe and analyze the characteristics of PWH screened for HCV antibodies; second, to describe those who have chronic HIV/HCV coinfection; third, to characterize and analyze coinfected patients who were treated using DAA therapy; and finally, to analyze the characteristics of those who achieved sustained virologic response 12 weeks after completing DAA treatment (SVR-12)].

# METHODS

## Study Sites and Population

The HIV Research Network (HIVRN) is a consortium of 18 clinics that provide primary and specialty care to persons with HIV in the United States.[15] After deidentification, sites collect and send patient data and to a central coordinating center, where data are combined into a uniform database. Local institutional review boards approved the collection of data at each site, and the institutional review board of Johns Hopkins University approved the collection and analysis of these data. Data from 12 adult clinics (7 academic and 5 community-based) located in the Eastern (6), Southern (2), Midwestern (1), and Western (3) regions of the United States were included in analysis.

PWH seen at least once between January 1, 2014, and December 31, 2015, at HIVRN sites by an HIV provider were eligible for inclusion in this retrospective cohort study. Additional inclusion criteria included having at least 1 HIV viral load assessment (HIV-1 RNA) or at least 1 CD4 cell count during the study period. For outcomes of HCV antibody screening, HCV antibody-positivity, and HCV RNA viral load, historic data were assessed retroactively to January 1, 2004.

DAA intention-to-treat and DAA treatment analysis was limited to patients who had a confirmatory HCV RNA test and included patients who had HCV RNA viral load (HCV VL) above a detectable threshold at any time before 2016. In addition, only patients in care at HIVRN sites (N = 9) that provided and reported HCV treatment data were included in the DAA treatment and SVR analysis.

Intention-to-treat analysis included all patients who were prescribed DAA during the 2014 and 2015 calendar years. A second treatment analysis was performed and only included those who were prescribed DAA and showed evidence of treatment initiation (HCV VL<500 copies/mL), and a subsequent 122 patients were excluded from the second treatment analysis. Patients were included in SVR analysis only if they met the criteria above and had an HCV RNA drawn at least 12 weeks after DAA treatment stoppage; 96 patients were excluded from SVR analysis. Achievement of SVR-12 was defined as having an HCV RNA that was undetectable at least 12 weeks after completion of HCV treatment.[16]

## Variable Definitions

Demographic and clinical characteristics (sex, race/ ethnicity, HIV transmission risk, and health care coverage) were recorded at the time of the first outpatient visit for each patient. Patients' age was categorized as under 40 years, 40–49, 50–59, and 60 and older, as of January 1, 2014. Sex was defined as male, female, or transgender; other/unknown sex (N = 3) were excluded from the study population. Race and ethnicity were categorized as black, white, Hispanic, and other/unknown. Self-reported primary HIV risk transmission factor was defined as heterosexual contact (HET), men who have sex with men (MSM), people with history of injection drug use (PWID), and other/unknown. Those with both sexual and PWID risk factors were categorized as PWID. Those with both MSM and HET were categorized as MSM. Health care coverage was categorized as public (Medicaid, Medicare, or both), private insurance, uninsured/Ryan White HIV/AIDS Program, and other/unknown.

Baseline clinical factors were determined for all patients and refer to the first encounter of the study period (2014–2015). CD4 cell counts were categorized as <200, 200–349, 350–499, and ≥500 cells/μL. HIV-1 RNA was categorized as detectable at >400 copies/mL or undetectable if less than or equal to 400 copies/mL. Dates of ART initiation and stoppage were recorded for each patient. ART therapy was recorded if a patient was prescribed ART at any time during the study period. For patients who were prescribed DAA therapy, clinical factors (ART, HIV RNA, CD4, and health care coverage) were again determined at the time of DAA prescription.

For HCV/HIV-coinfected patients, DAA therapy was defined as being prescribed any single or combination DAA regimen (including any of ledipasvir/sofosbuvir with and without ribavirin, simeprevir plus sofosbuvir with and without ribavirin, sofosbuvir plus ribavirin, or paritaprevir/ ritonavir/ombitasvir plus dasabuvir). Dates of DAA prescription and discontinuation were recorded for all patients prescribed DAA. Fibrosis was categorized using FIB-4 indexes as described by Sterling et al[17] and was categorized as: low (< 1.45), moderate (1.45–3.25), and severe (>3.25) fibrosis.

### Statistical Analysis

Descriptive analyses of demographic and clinical characteristics were performed separately among the different subpopulations of PWH in the cohort; those who were HCV antibody screened, those who were HCV antibody-positive, those with an HCV RNA above detectable threshold (≥50 copies/mL), those DAA-treated, and finally for SVR-12 outcomes among patients with adequate follow-up.

We then analyzed the association between each covariate and the HCV outcome using univariate and multivariate logistic regression analysis. For the outcomes of DAA treatment and SVR-12, our regressions used clinical characteristics at the time of DAA prescription. *P* values less than 0.05 were considered to be significant. Goodness of fit and area under the receiver operating characteristic curve (ROC) were calculated for each multivariate regression. All analysis was performed using STATA 14.2 (Stata Corporation, College Station, TX). Consistent with HIVRN authorship rules, all regressions are adjusted for the site of care to account for variations in practice patterns and demographic differences.

## RESULTS

### All Subjects

The sample population included 29,071 PWH, with a median age of 47 years [interquartile range (IQR) 37–54 years] as of January 1, 2014. The patients included were predominately male (74.8%), black (44.4%), and MSM (48.7%). A majority of patients had a CD4 cell count greater than 200 cells/$mm^3$ (86.5%), were prescribed ART (95.5%), were HIV-virally suppressed (75.2%), and had public health care coverage (60.9%), at their first visit during the study period (Table 1).

### HCV Antibody Screening

Nearly 78% of PWH followed at HIVRN sites were screened for HCV antibodies (Fig. 1). The median age of the 22,632 patients screened was 47 years (IQR 37–54). Patients were predominantly male (76.0%), MSM (50.0%), prescribed ART (95.7%), had undetectable viral loads (74.3%), had CD4 counts greater than 200 cells/mm$^3$ (85.9%), and had public health care coverage (62.8%) (Table 1). In multivariate regression (N = 29,071, ROC = 0.75), PWID {adjusted odds ratio (AOR) 3.35 [95% confidence interval (CI): 2.95 to 3.80]} were more likely to be screened for HCV than those with heterosexual risk. After adjustment for other factors, whites [AOR 0.87 (0.80 to 0.94)] and Hispanics [AOR 0.81 (0.75 to 0.88)] were less likely to be HCV antibody screened than blacks. Persons older than 60 years [AOR 0.81 (0.73 to 0.91)] and persons with private insurance [AOR 0.73 (0.66 to 0.80)] were less likely to be screened for HCV than younger patients and those with public health care coverage (Table 3).

### HIV/HCV Coinfection

Among those screened for HCV antibodies, 7447 (32.9%) were HCV Ab-positive. The median age for antibody-positive patients was 51 years (IQR 44–57) (Table 1). A majority of these patients were male (75.6%) and predominantly black (43.6%). More than one-third of antibody-positive patients were MSM (36.6%) while 31.3% were PWID. The majority of patients were prescribed ART (96.1%), had CD4 counts >200 cells/mL (84.1%), had undetectable HiV viral loads (78.4%), and had public health care coverage (72.4%) (Table 1). In multivariate regression (N = 22,633, ROC = 0.76), factors associated with HCV antibody-positivity included PWID [AOR 8.70 (7.74 to 9.78)], male sex [AOR 1.24 (1.13 to 1.36)], and age over 40, compared with heterosexuals, female sex, and younger age. Patients with private insurance were less likely to be antibody-positive [AOR 0.59 (0.54 to 0.66)] than those with public health care coverage (Table 3).

### DAA Intention to Treat and DAA Treatment

Of those with positive HCV antibody tests, 7047 (94.6%) had a confirmatory HCV RNA test (Table 1). Of this subset, 4305 had an HCV RNA viral load above the detectable threshold and were considered eligible for treatment with DAA (Table 1). Because of data collection limitations, only 2179 (50.6%) were located at sites with available DAA treatment data and thus were eligible to be followed for treatment and SVR-12 (Table 2).

Of these patients, 509 (23.4%) were prescribed DAA therapy between January 1, 2014, and December 31, 2015. The median age of patients prescribed DAA was 55 years (IQR 51–59 years). A majority of the DAA-treated patients were male (73.5%), black (67.6%), and PWID (57.6%). At the time of DAA prescription, a majority of patients were prescribed ART (86.1%), had a CD4 count above 200 cells/mm$^3$ (91.2%), had an undetectable HIV viral load (96.7%), and had public health care coverage (85.5%). Nearly two-thirds (63.9%) of patients prescribed DAA had moderate to severe fibrosis (Table 2). In multivariate regression (N = 1,846, ROC = 0.79), older age was associated with intention to treat {ages 50–59 years [AOR 2.08 (1.12 to 3.87)]; ≥60 years [AOR 2.11 (1.09 to 4.09)]}, as was undetectable HIV-1 RNA [AOR 2.52 (1.70 to 3.72)], prescription of ART [AOR 2.13 (1.13 to 3.99)], and FIB-4 score that was moderate [AOR 1.74 (1.34 to 2.27)] or severe [AOR 2.30

(1.59 to 3.31)] (Table 3). Few differences were found among those prescribed DAA and those who evidenced DAA initiation. However, white and Hispanic patients were less likely to be prescribed DAA {white [AOR 0.56 (0.40 to 0.79)]; Hispanic [AOR 0.63 (0.41 to 0.97)]} compared with black race, whereas all races were equally as likely to initiate DAA treatment.

### Sustained Virologic Response at 12 Weeks

Of the 387 patients prescribed DAA, 291 had an HCV RNA viral load at least 12 weeks after DAA completion. Of these 291 patients, the median age was 55 years (IQR 51–60 years). A majority of patients were male (75.6%), black (68.7%), and PWΓD (59.1%). At the time of DAA treatment, a majority of patients were prescribed ART (86.3%), had CD4 counts above 200 cells/mm$^3$ (91.4%), had undetectable HΓV viral loads (97.9%), and had public health care coverage (85.9%) (Table 2).

Of the patients followed with sufficient follow-up for evaluation of SVR-12, 277 (95.2%) achieved SVR-12 (Fig. 2). There were no clinical or demographic factors significantly associated with SVR in multivariate regression (N = 225, ROC = 0.77).

## DISCUSSION

This study has several important findings. First, although rates for screening for HCV are high, screening remains far from comprehensive among PWH, with more than 1 in 5 PWH engaged in HIV care not being screened. However, most persons (94.6%) with positive antibody tests had follow-up RNA testing. Second, among those with HCV coinfection, older persons, persons with moderate and severe fibrosis, persons being prescribed ART, and persons with undetectable HIV viral loads were more likely to be pre-scribed DAA therapy than younger patients and those with HIV viremia. Finally, rates of SVR among those followed through treatment end were high, consistent with previously published literature.[16,18,19]

In our study, approximately 22% of patients were not appropriately screened for HCV and disparities existed, despite the Department of Health and Human Services' (DHHS) recommendation for universal HCV screening among persons with HIV. Noticeably, a substantial portion of baby boomers (age 50–69) (20.6%) and a large number of patients with risk history of injection drug use (11.6%) were not screened for HCV. Efforts to screen all PWH should be intensified. Ideally, all PWH should be screened on entry to HIV care, with subsequent to annual screening for patients without HCV at baseline who have ongoing risk factors for contracting HCV.[20–22]

Consistent with previous work, we demonstrated that older patients with more advanced liver disease were more likely to be prescribed DAA therapy than younger HIV/HCV-coinfected persons with less extensive disease. This likely represents the initial health care payer restrictions for accessing DAA during the study period.[23] A majority of health care payer formularies listed strict requirements for the prescription of DAA, which focused on patients with severe fibrosis and/or cirrhosis. The pathology of chronic HCV results in liver damage over an extended period, which is directly correlated with patient age. Persons with

undetectable HIV-1 RNA were more than 2 times as likely to be prescribed DAA than persons with detectable HIV-1 RNA, while persons with CD4 counts less than 200 cells/mm$^3$ were less likely to be prescribed DAA. This may be indicative of a provider-level and/or systematic bias relating to medication adherence, AIDS status, and HIV-1 RNA viral load; providers may have been limiting care to "ideal patients" as determined by payers and government agencies.[24,25] In addition, health beliefs, stigma and medication, and appointment adherence have been shown to be strongly associated with engagement in HCV care.[26–28] However, these barriers were often seen before the era of DAA medications.[29]

Like others who have demonstrated high SVR rates with DAA, we found SVR in excess of 90%.[30,31] Because of the high success rate and relatively limited sample size, we found no clinical or demographic predictors associated with achieving SVR. This is consistent with other work previously done in HCV-HIV coinfection, reinforcing the concept of comprehensive screening and treatment.

This study has several important limitations. First, the HIVRN represents a sample of high-volume HIV primary care clinics, which may not be representative of all clinics that care for HIV/HCV-coinfected patients. Within the consortium, however, DAA prescription data were not available or not able to be validated at all sites, resulting in a smaller sample size. In addition, because of reporting rules of the HIVRN, site-by-site variation cannot be reported. We attempted to assess for variation based on US Census Region and clinic type (academic medical center or communitybased); however, these corrections diminished the strength of logistic regression models for all outcomes.

Second, active illicit drug use, alcohol consumption, mental health comorbidities, and engagement in HCV care (referral to HCV providers and HCV appointment keeping behavior) have been key factors for exclusion of DAA treatment, both in clinical trials and health care payer formularies.[27,28,32] We did not capture these factors, nor did we capture referrals for HCV treatment to either subspecialty clinics (hepatology) or infectious disease clinics within or not a HIV primary care system; we believe that the inclusion of this data would greatly improve the multivariate models. Finally, HCV management has changed since the advent of DAA, and further studies need to be conducted with the newer therapies available and lift of many insurance barriers for accessing newer DAA therapies.

In summary, this analysis demonstrated high rates of screening and successful treatment. However, gaps remain in screening and treatment of patients coinfected with HCV and HIV. Further work should be performed to better understand the barriers set by governments and individual insurers, both in the private and public managed care realms, in addition to the patient- and provider-perceived barriers to DAA completion.

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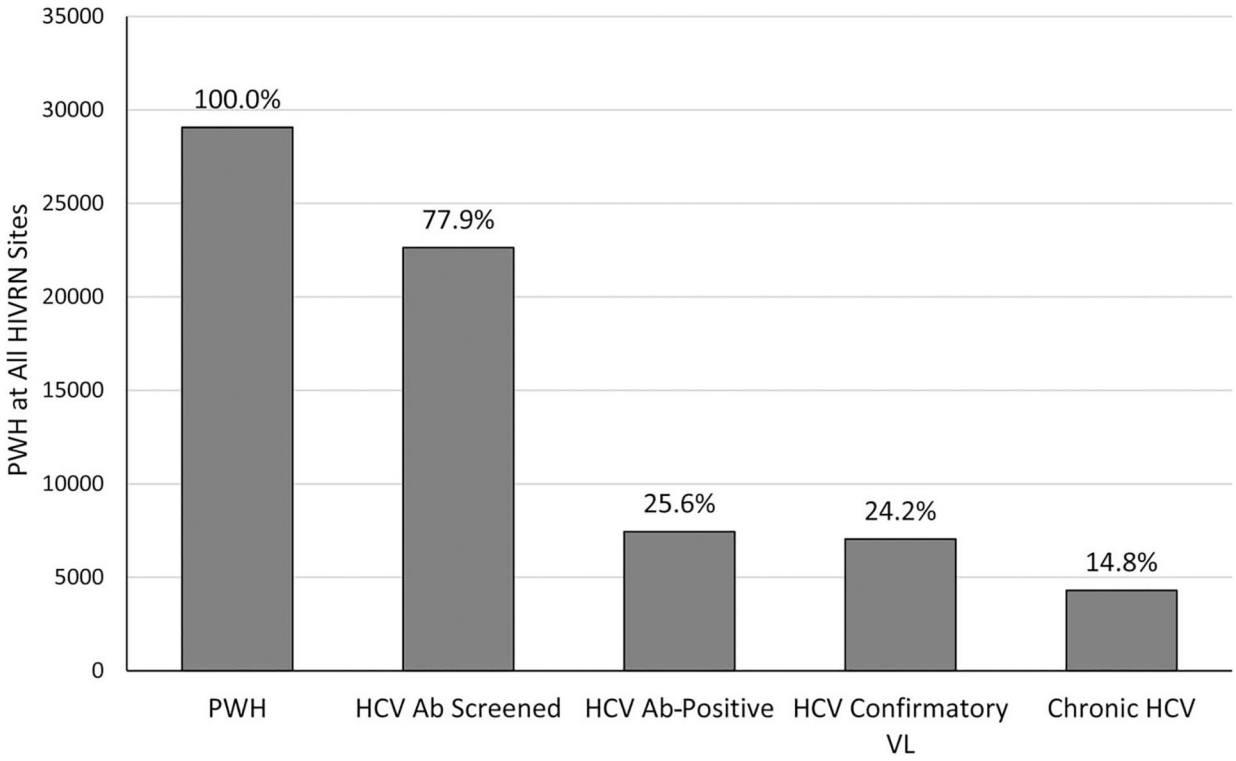


**FIGURE 1.**

Proportion of PWH at all sites screened for HCV Ab, HCV Ab+, having confirmatory HCV viral load testing, and with chronic HCV infection.

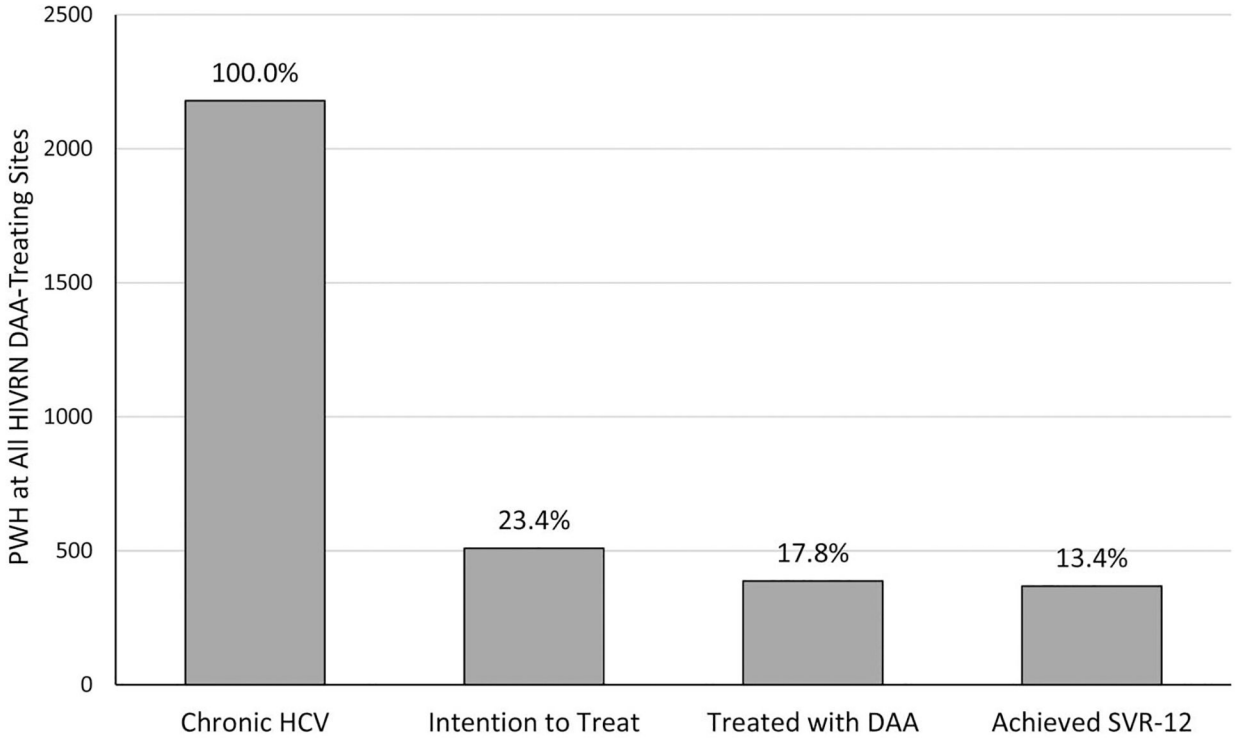


**FIGURE 2.**

Proportion of PWH with chronic HCV infection at treating sites who were prescribed DAA, had evidence of DAA treatment, and who achieved SVR-12.

**TABLE 1.**

Clinical and Demographic Characteristics of HIV-Infected Patients, PWH Screened for HCV, HIV/HCV-Coinfected Patients, and PWH Eligible for DAA Treatment

| Variable | Overall PWH N = 29,071 | HCV Ab Screening N = 22,632 | HCV Ab-Positive N = 7447 | HCV Confirmatory Viral Load Testing N = 7047 | Elevated HCV Viral Load N = 4305 |
|---|---|---|---|---|---|
| Age, years [median (IQR)] | 47 (37–54) | 47 (37–54) | 51 (44–57) | 51 (44–57) | 53 (47–58) |
| <40 | 9176 (31.6) | 7077 (31.3) | 1242 (16.7) | 1148 (16.3) | 482 (11.2) |
| 40–49 | 8737 (30.1) | 6733 (29.8) | 2171 (29.2) | 2052 (29.1) | 1129 (26.2) |
| 50–59 | 8190 (28.2) | 6526 (28.8) | 2967 (39.8) | 2821 (40.0) | 1955 (45.4) |
| >60 | 2968 (10.2) | 2296 (10.1) | 1067 (14.3) | 1026 (14.6) | 739 (17.2) |
| Sex | | | | | |
| Male | 21,756 (74.8) | 17,191 (76.0) | 5630 (75.6) | 5348 (75.9) | 3210 (74.6) |
| Female | 7026 (24.2) | 5198 (23.0) | 1751 (23.5) | 1637 (23.2) | 1053 (24.5) |
| Transgender | 289 (1.0) | 243 (1.1) | 66 (0.9) | 62 (0.9) | 42 (1.0) |
| Race | | | | | |
| Black | 12,906 (44.4) | 9649 (42.6) | 3245 (43.6) | 3062 (43.5) | 2113 (49.1) |
| White, not Hispanic | 7980 (27.5) | 6441 (28.5) | 2100 (28.2) | 1980 (28.1) | 1013 (23.5) |
| Hispanic | 7015 (24.1) | 5664 (25.0) | 1866 (25.1) | 1773 (25.2) | 1048 (24.3) |
| Other/unknown | 1170 (4.0) | 878 (3.9) | 236 (3.2) | 232 (3.3) | 131 (3.0) |
| HIV acquisition risk | | | | | |
| PWID | 3229 (11.1) | 2856 (12.6) | 2328 (31.3) | 2224 (31.6) | 1836 (42.7) |
| MSM | 14,170 (48.7) | 11,324 (50.0) | 2728 (36.6) | 2591 (36.8) | 1178 (27.4) |
| HET | 9959 (34.3) | 7237 (32.0) | 2040 (27.4) | 1900 (27.0) | 1088 (25.3) |
| Other/unknown | 1713 (5.9) | 1215 (5.4) | 351 (4.7) | 332 (4.7) | 203 (4.7) |
| Health care coverage | | | | | |
| Public | 17,702 (60.9) | 14,207 (62.8) | 5391 (72.4) | 5136 (72.9) | 3534 (82.1) |
| Private insurance | 4617 (15.9) | 3548 (15.7) | 782 (10.5) | 749 (10.6) | 298 (6.9) |
| Uninsured/Ryan White | 6362 (21.9) | 4619 (20.4) | 1152 (15.5) | 1049 (14.9) | 381 (8.9) |
| Other/unknown | 390 (1.3) | 258 (1.1) | 122 (1.6) | 113 (1.6) | 92 (2.1) |
| ART | | | | | |
| ART treated | 27,771 (95.5) | 21,661 (95.7) | 7157 (96.1) | 6791 (96.4) | 4131 (96.0) |

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| Variable | Overall PWH N = 29,071 | HCV Ab Screening N = 22,632 | HCV Ab-Positive N = 7447 | HCV Confirmatory Viral Load Testing N = 7047 | Elevated HCV Viral Load N = 4305 |
|---|---|---|---|---|---|
| HIV RNA | | | | | |
| <400 copies/mL | 21,861 (75.2) | 16,825 (74.3) | 5839 (78.4) | 5559 (78.9) | 3453 (80.2) |
| >400 copies/mL | 7210 (24.8) | 5807 (25.7) | 1608 (21.6) | 1488 (21.1) | 852 (19.8) |
| CD4 T cells (median, IQR) | 512 (318–727) | 508 (312–724) | 482 (284–698) | 483 (285–698) | 489 (295–703) |
| <200 | 3928 (13.5) | 3189 (14.1) | 1181 (15.9) | 1103 (15.7) | 620 (14.4) |
| 200–349 | 4399 (15.1) | 3419 (15.1) | 1250 (16.8) | 1188 (16.9) | 745 (17.3) |
| 350 — 99 | 5695 (19.6) | 4440 (19.6) | 1475 (19.8) | 1394 (19.8) | 847 (19.7) |
| >500 | 15,049 (51.8) | 11,584 (51.2) | 3541 (47.6) | 3362 (47.7) | 2093 (48.6) |
| Fib-4 fibrosis score | | | | | |
| Low (<1.45) | — | — | 3430 (46.1) | 3293 (46.7) | 1667 (38.7) |
| Intermediate (1.45–3.25) | — | — | 2412 (32.4) | 2329 (33.1) | 1619 (37.6) |
| Severe (>3.25) | — | — | 787 (10.6) | 757 (10.7) | 605 (14.1) |
| Missing | — | — | 818 (11.0) | 668 (9.5) | 414 (9.6) |

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**TABLE 2.**

Clinical and Demographic Characteristics of HIV/HCV-Coinfected Patients, Prescribed DAA Therapy, Initiating DAA Treatment, and Achieving SVR, at Sites Reporting DAA Treatment Data

| Variable | Elevated HCV Viral Load N = 2179 | Intention to Treat (Prescribed DAA) N = 509 | Treated With DAA* N = 387 | Sufficient Time to Assess SVR-12* N = 291 | Achieved SVR-12* N = 277 |
|---|---|---|---|---|---|
| Age, years [median (IQR)] | 53 (47–58) | 55 (51–59) | 55 (51–59) | 55 (51–60) | 55 (51–60) |
| <40 | 225 (10.3) | 15 (3.0) | 10 (2.6) | 6 (2.1) | 5 (1.8) |
| 40–49 | 582 (26.7) | 97 (19.1) | 71 (18.4) | 54 (18.6) | 50 (18.1) |
| 50–59 | 1036 (47.5) | 292 (57.4) | 224 (57.9) | 168 (57.7) | 162 (58.5) |
| >60 | 336 (15.4) | 105 (20.6) | 82 (21.2) | 63 (21.7) | 60 (21.7) |
| Sex | | | | | |
| Male | 1604 (73.6) | 374 (73.5) | 288 (74.4) | 220 (75.6) | 212 (76.5) |
| Female | 562 (25.8) | 132 (25.9) | 97 (25.1) | 69 (23.7) | 63 (22.7) |
| Transgender | 13 (0.6) | 3 (0.6) | 2 (0.5) | 2 (0.7) | 2 (0.7) |
| Race | | | | | |
| Black | 1161 (53.3) | 344 (67.6) | 252 (65.1) | 200 (68.7) | 192 (69.3) |
| White, not Hispanic | 589 (27.0) | 99 (19.5) | 83 (21.5) | 62 (21.3) | 60 (21.7) |
| Hispanic | 353 (16.2) | 56 (11.0) | 46 (11.9) | 25 (8.6) | 21 (7.6) |
| Other/unknown | 76 (3.5) | 10 (2.0) | 6 (1.6) | 4 (1.4) | 4 (1.4) |
| HIV acquisition risk | | | | | |
| PWID | 1069 (49.1) | 293 (57.6) | 223 (57.6) | 172 (59.1) | 163 (58.8) |
| MSM | 516 (23.7) | 86 (16.9) | 62 (16.0) | 48 (16.5) | 47 (17.0) |
| HET | 480 (22.0) | 97 (19.1) | 74 (19.1) | 52 (17.9) | 48 (17.3) |
| Other/unknown | 114 (5.2) | 33 (6.5) | 28 (7.2) | 19 (6.5) | 19 (6.9) |
| Health care coverage | | | | | |
| Public | 1730 (79.4) | 435 (85.5) | 330 (85.3) | 250 (85.9) | 237 (85.6) |
| Private insurance | 206 (9.5) | 54 (10.6) | 46 (11.9) | 34 (11.7) | 33 (11.9) |
| Uninsured/Ryan White | 156 (7.2) | 5 (1.0) | 5 (1.3) | 3 (1.0) | 3 (1.1) |
| Other/unknown | 87 (4.0) | 4 (0.8) | 3 (0.8) | 2 (0.7) | 2 (0.7) |
| Missing | — | 11 (2.2) | 3 (0.8) | 2 (0.7) | 2 (0.7) |
| ART | | | | | |

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| Variable | Elevated HCV Viral Load N = 2179 | Intention to Treat (Prescribed DAA) N = 509 | Treated With DAA* N = 387 | Sufficient Time to Assess SVR-12* N = 291 | Achieved SVR-12* N = 277 |
|---|---|---|---|---|---|
| ART treated | 2086 (95.7) | 438 (86.1) | 339 (87.6) | 251 (86.3) | 240 (86.6) |
| HIV RNA | | | | | |
| <400 copies/mL | 1771 (81.3) | 492 (96.7) | 377 (97.4) | 285 (97.9) | 272 (98.2) |
| >400 copies/mL | 408 (18.7) | 12 (2.4) | 7 (1.8) | 4 (1.4) | 3 (1.1) |
| Missing | — | 5 (1.0) | 3 (0.8) | 2 (0.7) | 2 (0.7) |
| CD4 T cells (median, IQR) | 500 (307–719) | 564 (364–787) | 562 (368–773) | 557 (369–796) | 560 (372–795) |
| <200 | 288 (13.2) | 27 (5.3) | 18 (4.7) | 13 (4.5) | 11 (4.0) |
| 200–349 | 371 (17.0) | 84 (16.5) | 66 (17.1) | 48 (16.5) | 45 (16.3) |
| 350–499 | 428 (19.6) | 99 (19.5) | 74 (19.1) | 60 (20.6) | 56 (20.2) |
| >500 | 1092 (50.1) | 281 (55.2) | 214 (55.3) | 158 (54.3) | 153 (55.2) |
| Missing | — | 18 (3.5) | 15 (3.4) | 12 (4.1) | 12 (4.3) |
| Fib-4 fibrosis score | | | | | |
| Low (<1.45) | 869 (39.9) | 165 (32.4) | 123 (31.8) | 84 (28.9) | 82 (29.6) |
| Intermediate (1.45–3.25) | 729 (33.5) | 238 (46.8) | 180 (46.5) | 141 (48.5) | 134 (48.4) |
| Severe (>3.25) | 248 (11.4) | 87 (17.1) | 72 (18.6) | 57 (19.6) | 53 (19.1) |
| Missing | 333 (15.3) | 19 (3.7) | 12 (3.1) | 9 (3.1) | 8 (2.9) |

*Characteristics (ART, HГV viral load, CD4, and insurance) at time of treatment.

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**TABLE 3.**

Logistic Regression of Clinical and Demographic Characteristics of PWH Screened for HCV, Prescribed DAA Therapy, Treated With DAA, and Achieving SVR, Controlling for Site

| | HCV Ab Screening (N = 29,071) | | HCV Ab-Positive (N = 22,633) | |
|---|---|---|---|---|
| **Variable** | **Univariate OR (95% CI)** | **Multivariate AOR (95% CI)** | **Univariate OR (95% CI)** | **Multivariate AOR (95% CI)** |
| Age, years | | | | |
| <40 | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) |
| 40–49 | 0.95 (0.89 to 1.03) | **0.89 (0.83 to 0.96)** | **2.30 (2.11 to 2.49)** | **2.01 (1.84 to 2.19)** |
| 50–59 | **1.13 (1.05 to 1.23)** | 0.96 (0.88 to 1.04) | **3.94 (3.63 to 4.28)** | **2.97 (2.72 to 3.24)** |
| >60 | 0.96 (0.86 to 1.07) | **0.81 (0.73 to 0.91)** | **4.26 (3.83 to 4.75)** | **3.04 (2.71 to 3.42)** |
| Sex | | | | |
| Male | 1.01 (0.94 to 1.08) | 0.99 (0.91 to 1.08) | **1.10 (1.03 to 1.18)** | **1.24 (1.13 to 1.36)** |
| Female | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) |
| Transgender | 1.14 (0.81 to 1.59) | 1.06 (0.76 to 1.50) | 0.98 (0.73 to 1.31) | 1.30 (0.94 to 1.79) |
| Race | | | | |
| Black | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) |
| White, not Hispanic | **0.88 (0.81 to 0.95)** | **0.87 (0.80 to 0.94)** | **1.22 (1.13 to 1.32)** | **1.10 (1.00 to 1.20)** |
| Hispanic | **0.83 (0.76 to 0.90)** | **0.81 (0.75 to 0.88)** | **1.25 (1.16 to 1.35)** | **1.40 (1.28 to 1.52)** |
| Other/unknown | **0.49 (0.42 to 0.57)** | **0.52 (0.45 to 0.61)** | 0.92 (0.78 to 1.08) | **1.23 (1.03 to 1.46)** |
| HIV acquisition risk | | | | |
| PWID | **3.33 (2.94 to 3.77)** | **3.35 (2.95 to 3.80)** | **10.60 (9.49 to 11.85)** | **8.70 (7.74 to 9.78)** |
| MSM | 1.03 (0.96 to 1.10) | 1.08 (1.00 to 1.18) | **0.89 (0.82 to 0.95)** | 0.93 (0.85 to 1.02) |
| HET | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) |
| Other/unknown | **0.56 (0.49 to 0.64)** | **0.58 (0.51 to 0.67)** | 1.10 (0.96 to 1.27) | **1.19 (1.03 to 1.38)** |
| Health care coverage | | | | |
| Public | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) |
| Private insurance | **0.65 (0.60 to 0.71)** | **0.73 (0.66 to 0.80)** | **0.46 (0.42 to 0.50)** | **0.59 (0.54 to 0.66)** |
| Uninsured/Ryan White | **0.87 (0.81 to 0.95)** | 0.94 (0.86 to 1.02) | **0.43 (0.40 to 0.47)** | **0.60 (0.54 to 0.66)** |
| Other/unknown | **0.63 (0.50 to 0.79)** | **0.58 (0.46 to 0.73)** | 1.03 (0.79 to 1.36) | 1.00 (0.74 to 1.37) |
| ART | | | | |
| ART treated | | | | |

| Variable | HCV Ab Screening (N = 29,071) | | HCV Ab-Positive (N = 22,633) | |
|---|---|---|---|---|
| | Univariate OR (95% CI) | Multivariate AOR (95% CI) | Univariate OR (95% CI) | Multivariate AOR (95% CI) |
| HIV RNA | | | | |
| <400 copies/mL | | | | |
| CD4 T cells | | | | |
| <200 | | | | |
| 200–349 | | | | |
| 350–499 | | | | |
| >500 | | | | |
| Fib-4 fibrosis score | | | | |
| Low (<1.45) | | | | |
| Intermediate (1.45–3.25) | | | | |
| Severe (>3.25) | | | | |
| ROC | | **0.75** | | **0.76** |

| Variable | Intention to Treat (N =1846) | | Treated With DAA (N =1846) | | Achieved SVR-12* (N = 225) | |
|---|---|---|---|---|---|---|
| | Univariate OR (95% CI) | Multivariate AOR (95% CI) | Univariate OR (95% CI) | Multivariate AOR (95% CI) | Univariate OR (95% CI) | Multivariate AOR (95% CI) |
| Age, years | | | | | | |
| <40 | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) |
| 40–49 | **2.06 (1.14 to 3.72)** | 1.55 (0.82 to 2.94) | **2.29 (1.14 to 4.60)** | 1.83 (0.86 to 3.90) | 1.30 (0.09 to 18.70) | 8.38 (0.07 to 941.43) |
| 50–59 | **3.32 (1.89 to 5.83)** | **2.08 (1.12 to 3.87)** | **3.74 (1.91 to 7.32)** | **2.48 (1.19 to 5.20)** | 3.54 (0.28 to 44.87) | 16.70 (0.17 to 1639.57) |
| >60 | **3.94 (2.16 to 7.18)** | **2.11 (1.09 to 4.09)** | **4.39 (2.17 to 8.87)** | **2.61 (1.20 to 5.66)** | 3.00 (0.20 to 44.36) | 9.67 (0.09 to 1061.86) |
| Sex | | | | | | |
| Male | 1.21 (0.94 to 1.55) | 1.11 (0.83 to 1.49) | 1.28 (0.98 to 1.69) | 1.26 (0.92 to 1.72) | 1.97 (0.63 to 6.14) | 1.93 (0.38 to 9.84) |
| Female | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) |
| Transgender | 1.74 (0.46 to 6.58) | 1.85 (0.45 to 7.56) | 1.55 (0.33 to 7.31) | 1.69 (0.32 to 8.89) | — | — |
| Race | | | | | | |
| Black | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) |
| White, not Hispanic | **0.59 (0.43 to 0.81)** | **0.56 (0.40 to 0.79)** | 0.73 (0.52 to 1.02) | 0.75 (0.52 to 1.09) | 0.63 (0.12 to 3.39) | 1.26 (0.16 to 9.79) |
| Hispanic | **0.61 (0.41 to 0.90)** | **0.63 (0.41 to 0.97)** | **0.58 (0.38 to 0.88)** | 0.64 (0.40 to 1.02) | 0.17 (0.02 to 1.51) | 0.82 (0.06 to 11.86) |
| Other/unknown | 0.56 (0.27 to 1.17) | 0.56 (0.26 to 1.21) | 0.42 (0.17 to 1.03) | 0.44 (0.17 to 1.11) | — | — |
| HIV acquisition risk | | | | | | |

| Variable | Intention to Treat (N =1846) | | Treated With DAA (N =1846) | | Achieved SVR-12* (N = 225) | |
|---|---|---|---|---|---|---|
| | Univariate OR (95% CI) | Multivariate AOR (95% CI) | Univariate OR (95% CI) | Multivariate AOR (95% CI) | Univariate OR (95% CI) | Multivariate AOR (95% CI) |
| PWID | 0.88 (0.66 to 1.87) | 0.80 (0.57 to 1.11) | 0.92 (0.67 to 1.26) | 0.83 (0.58 to 1.17) | 1.18 (0.33 to 4.23) | 0.97 (0.18 to 5.41) |
| MSM | 0.91 (0.62 to 1.33) | 0.91 (0.59 to 1.40) | 0.84 (0.55 to 1.27) | 0.77 (0.48 to 1.23) | 1.91 (0.19 to 19.46) | 1.81 (0.10 to 31.28) |
| HET | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) |
| Other/unknown | 1.02 (0.61 to 1.71) | 0.95 (0.54 to 1.67) | 1.04 (0.61 to 1.78) | 0.94 (0.52 to 1.68) | — | — |
| Health care coverage | | | | | | |
| Public | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) |
| Private insurance | 0.95 (0.65 to 1.39) | 0.92 (0.61 to 1.39) | 1.05 (0.69 to 1.57) | 0.98 (0.63 to 1.52) | 1.39 (0.17 to 11.37) | 0.91 (0.08 to 10.52) |
| Uninsured/Ryan White | **0.48 (0.26 to 0.89)** | 0.52 (0.26 to 1.04) | 0.56 (0.29 to 1.08) | 0.59 (0.28 to 1.26) | — | — |
| Other/unknown | 0.91 (0.55 to 1.50) | 1.11 (0.63 to 1.95) | 0.94 (0.55 to 1.61) | 1.11 (0.62 to 2.01) | — | — |
| ART | | | | | | |
| ART treated | 2.19 (1.23 to 3.88) | **2.13 (1.13 to 3.99)** | **2.57 (1.30 to 5.08)** | **2.27 (1.11 to 4.64)** | 2.31 (0.53 to 10.15) | 1.83 (0.36 to 9.20) |
| HIV RNA | | | | | | |
| <400 copies/mL | 3.08 (2.18 to 4.34) | **2.52 (1.70 to 3.72)** | **3.30 (2.22 to 4.92)** | **2.67 (1.71 to 4.18)** | 5.38 (0.48 to 60.06) | 2.16 (0.03 to 154.17) |
| CD4 T cells | | | | | | |
| <200 | 0.53 (0.37 to 0.78) | 0.71 (0.46 to 1.10) | **0.53 (0.35 to 0.80)** | 0.74 (0.46 to 1.19) | **0.15 (0.02 to 0.95)** | 0.11 (0.01 to 1.13) |
| 200–349 | 0.85 (0.63 to 1.16) | 0.97 (0.69 to 1.35) | 0.84 (0.60 to 1.16) | 0.94 (0.66 to 1.34) | 0.39 (0.09 to 1.80) | 0.31 (0.58 to 1.71) |
| 350–499 | 1.04 (0.79 to 1.38) | 1.07 (0.79 to 1.45) | 0.93 (0.69 to 1.26) | 1.02 (0.74 to 1.40) | 0.46 (0.12 to 1.80) | 0.37 (0.06 to 2.11) |
| >500 | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) |
| Fib-4 fibrosis score | | | | | | |
| Low (<1.45) | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) | 1.0 (Ref) |
| Intermediate (1.45–3.25) | **1.81 (1.41 to 2.32)** | **1.74 (1.34 to 2.27)** | **1.75 (1.34 to 2.29)** | **1.63 (1.23 to 2.16)** | 0.38 (0.08 to 1.94) | 0.49 (0.08 to 2.85) |
| Severe (>3.25) | **2.31 (1.64 to 3.25)** | **2.30 (1.59 to 3.31)** | **2.45 (1.71 to 3.51)** | **2.29 (1.56 to 3.36)** | 0.24 (0.04 to 1.46) | 0.36 (0.05 to 2.52) |
| ROC | | **0.79** | | **0.78** | | **0.77** |

Bolded values indicate significance at $P = 0.05$.

*Characteristics (ART, HIV viral load, CD4, and insurance) at time of treatment.

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