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MAJOR ARTICLE

Hepatitis C Elimination in People With HIV Is Contingent on Closing Gaps in the HIV Continuum

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Background. Bolstered by the high efficacy of hepatitis C virus (HCV) treatment, the World Health Organization has called for HCV elimination by 2030. People with HIV (PWH) have been identified as a population in which elimination should be prioritized.

Methods. We examined progress in HCV elimination through the HCV care continuum among patients infected with HIV/HCV receiving HIV care at Johns Hopkins Hospital in Baltimore, Maryland, United States. Patients with HIV care visits in at least 2 consecutive years were followed through December 15, 2018, for referral to HCV care, treatment initiation, and cure.

Results. Among 593 HIV/HCV-coinfected individuals, 547 (92%) were referred for HCV care, 517 (87%) were evaluated for HCV treatment, 457 (77%) were prescribed HCV treatment, 426 (72%) initiated treatment, and 370 (62%) achieved HCV cure. In multivariable analysis, advanced liver disease (hazard ratio [HR], 1.48; 95% confidence interval [CI], 1.17–1.88) remained significantly positively associated with HCV treatment initiation. Conversely, being insured by state Medicaid (HR, 0.75; 95% CI, 0.61–0.92), having an HIV RNA >400 copies/mL (HR, 0.29; 95% CI, 0.18–0.49), and having missed 1%–24% (HR, 0.72; 95% CI, 0.54–0.97), 25%–49% (HR, 0.66; 95% CI, 0.49–0.89), and ≥50% of HIV care visits (HR, 0.39; 95% CI, 0.25–0.60) were significantly negatively associated with HCV treatment initiation.

Conclusions. HCV infection can be eliminated in PWH. However, HCV elimination requires unrestricted access to HCV treatment and improved methods of retaining people in medical care.

Keywords. care continuum; hepatitis C; HIV; treatment.

HIV and hepatitis C virus (HCV) share similar modes of transmission. As such, people with HIV (PWH) have high rates of HCV infection [1]. PWH coinfected with HCV suffer markedly worse health outcomes, including accelerated rates of liver disease progression to cirrhosis, end-stage liver disease, and hepatocellular cancer (HCC) [2, 3]. In the interferon era, rates of HCV cure were also significantly lower and associated with major side effects, thus limiting the benefit of HCV treatment in HIV-infected populations [4–7]. With the advent of oral HCV direct-acting agent (DAA) therapies of short duration with minimal side effects, rates of HCV cure are >95% in both HIV-infected and uninfected populations [8]. DAA therapies improve quality-of-life measures and reduce rates of end-stage liver disease and HCC [9–11]. Increased uptake of DAA treatment can also reduce HCV transmission, resulting in fewer new HCV infections and reinfections [12].

Bolstered by the potential impact of DAAs, the World Health Organization (WHO) has endorsed elimination of HCV as a public health threat by 2030 [13, 14]. Specifically, the WHO targets are a 90% reduction in new infections and a 65% reduction in hepatitis-related mortality by 2030 (relative to 2015) [13]. Key milestones to accomplish these goals include diagnosis of 90% of HCV-infected individuals and HCV treatment in 80% of infected individuals. Understanding that eliminating HCV in the 71 million people infected globally will take coordinated and strategic efforts, the concept of HCV micro-elimination in specific populations has growing support [14, 15]. With micro-elimination, large national or global goals are broken into smaller and more easily achievable treatment and prevention goals using targeted methods for individual subpopulations.

Globally, there are an estimated 2.3 million PWH coinfected with HCV [1]. Similar to the WHO targets for HCV, in 2014, the Joint United Nations Program on HIV and AIDS (UNAIDS) established elimination targets for HIV infection. The 90-90-90 targets are that, by 2020, 90% of PWH will know their status, 90% of these will receive antiretroviral therapy (ART), and 90% of these will be virally suppressed; this program provides the infrastructure and foundation to layer HCV elimination in PWH.

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In this study, we characterize the ongoing barriers and facilitators to HCV care in HIV-infected populations in the oral DAA era as a bridge to developing appropriate strategies for HCV micro-elimination in HIV-infected populations.

METHODS

Study Population

This analysis included individuals receiving HIV care at the Johns Hopkins HIV clinical practice who are also enrolled in ongoing prospective observational cohort studies of HIV and HIV/HCV clinical outcomes. The HIV clinical cohort has previously been described [16]. For this analysis, participants were required to be receiving HIV care and to have evidence of HCV viremia (detectable HCV RNA) in the oral DAA era. Receipt of HIV care was defined as having at least 1 HIV care visit in 2 consecutive years between January 1, 2013, and December 31, 2016. Individuals who met these criteria were followed through March 31, 2018, for ascertainment of HCV treatment status and through December 15, 2018, for ascertainment of HCV treatment outcome status.

The Institutional Review Board of the Johns Hopkins University School of Medicine approved the research study, and all participants provided written informed consent.

Study Setting

The Johns Hopkins HIV clinical practice provides HIV care to a predominantly inner-city population with high rates of current and previous injection drug use. The co-located viral hepatitis clinic provides comprehensive care, including testing, evaluation, treatment, pharmacy prior authorization, and support for patient assistance program (PAP) applications for patients who have been denied insurance treatment coverage. HCV care is provided within the HIV care infrastructure, which is structured as multidisciplinary teams. Clinicians, nurses, and social workers work together to provide longitudinal care to defined groups of HIV patients. HIV providers refer patients to HCV care providers, who evaluate, prescribe, and treat hepatitis infections. A limited number of HIV providers treat HCV infection in their coinfected HIV continuity patients.

In the state of Maryland, where the Johns Hopkins Hospital is located, the Department of Health (DOH) has established criteria for HCV therapy paid for by Maryland Medicaid after approval of a prior authorization application. During the study period, payment for HCV therapy by Maryland Medicaid was restricted to patients with METAVIR stage ≥F2 liver disease [17]. At the Johns Hopkins HIV clinical practice, providers prescribe DAAs through the specialized Johns Hopkins Hospital outpatient pharmacy team, which navigates the process of prior authorization and written appeals of insurance denials. For patients denied by insurance, a dedicated team handles PAP applications to enable access to free HCV treatment. A subset of patients also accessed HCV therapy through clinical trials that were ongoing during the study period.

Data Collection

In addition to sociodemographic characteristics and laboratory values, data on referrals for HCV evaluation, scheduling, attendance at HCV and HIV appointments, HCV treatment prescription, and HCV treatment initiation and completion dates were extracted from the electronic medical record and supplemented through chart review. Additional information on HCV therapy prescription, start, and completion was extracted from pharmacy records. Death information was obtained using a combination of medical records and the National Death Index (NDI). Most study participants (527/593, 89%) had additional survey data collected using audio computer-assisted interview software (ACASI) at study visits, which was used to assess recent drug use and hazardous alcohol consumption.

Study Definitions

Sustained virologic response (SVR), also referred to as HCV cure, was defined as at least 1 HCV RNA result undetectable at <15 IU/mL drawn 12 or more weeks after the expected end of HCV treatment (EOT). To exclude relapse, reinfection was defined as an HCV RNA detectable at >15 IU/mL after previous evidence of achievement of SVR confirmed through chart review. A genotype switch in pre- and post-treatment virus was also considered evidence of HCV reinfection [18]. Liver disease staging was assessed by liver elastography (FibroScan, EchoSens, Paris, France), FibroTest, and FIB-4 (calculated from the patient's age, AST and AST levels, and platelet count) [19, 20]. Fasting liver stiffness measurements >12.5 KPA by elastography, FibroTest >0.79, or FIB-4 score >3.25 was considered evidence of cirrhosis. The cutoffs of >7.9 KPA by elastography or a FibroTest ≥0.48, which are accepted by the Maryland DOH, were considered evidence of ≥F2 liver disease [17]. Recent drug use was defined as self-reported use (collected through ACASI at study visits) of any illicit substances, including heroin or cocaine, in the prior 3 months. Hazardous alcohol use was defined as a score of ≥4 for men and ≥3 for women on the AUDIT-C, as reported by ACASI at study visits [21, 22].

Statistical Analyses

The study population was characterized with respect to demographics and risk behaviors at study baseline using descriptive statistics. Study baseline was the first HIV care visit (or the first study visit for data collected by ACASI) on or after January 1, 2013. To evaluate the HCV care continuum, the proportion of the study population referred for HCV care, attending HCV care, prescribed HCV treatment, initiating HCV treatment, and achieving SVR were calculated over the study period. Factors associated with HCV treatment initiation were evaluated among

all participants in the study. Participants entered the analysis at study baseline and exited at either March 31, 2018, or HCV treatment initiation (whichever came first). Time from study baseline was used as the time scale for the analysis. Time-fixed covariates of interest were anchored at study baseline and included sex, race, HIV transmission risk group, insurance, HCV genotype, fibrosis stage, history of alcohol abuse, tobacco use, psychiatric diagnoses, depression, prior HCV treatment, and current liver disease stage. Time-varying covariates of interest included CD4 count, HIV viral load, ART use, hazardous alcohol or illicit drug use, and missed HIV care visits. For time-varying covariates, values were carried forward and updated when new values were available. Missed HIV visits was calculated as the proportion of missed HIV visits over the total scheduled HIV visits, was accumulated from 1 year before study baseline, and was updated at each CD4 or viral load measure. A sensitivity analysis was conducted using number, instead of proportion of missed visits. Cox proportional hazard models were used to evaluate factors associated with treatment initiation. Hazard ratios and 95% confidence intervals are reported. Covariates that were statistically significant ($P < .05$) in the univariable analysis and race were included in the multivariable model. As engagement in HIV care was found to be important, an additional analysis was conducted comparing the characteristics between those engaged and not engaged in care using descriptive statistics. Two or more missed visits in the year before study baseline was defined as being poorly engaged in care [23]. All analyses were performed using SAS, version 9.4 (SAS Institute Inc., Cary, NC), and Stata, version 14.2 (StataCorp LLC., College Station, TX).

RESULTS

Of 2884 HIV-infected patients enrolled or in ongoing follow-up between January 1, 2013, and December 31, 2016, 672 had a diagnosis of HCV at study entry. Among the 2111 patients who did not have a diagnosis of HCV, 2010 (95.2%) were tested for anti-HCV and/or HCV RNA. Overall, 2783 (96.5%) patients were tested for HCV with anti-HCV and/or HCV RNA or had a diagnosis of HCV at study entry.

There were 978 patients with HIV visits in at least 2 consecutive years between January 1, 2013, and December 31, 2016, who had ever tested anti-HCV-positive, of whom 602 (62%) had a detectable HCV RNA during the study period. Of these 602 people, 9 (1%) had evidence of spontaneous HCV clearance and were excluded. Among the remaining 593 individuals, the median age was 53.9 years, and the majority were male (68%), black (89%), had a history of injection drug use (73%), and had a psychiatric diagnosis (58%) (Table 1). Twenty percent reported illicit drug use (including heroin and cocaine) in the preceding 3 months, and 45% received medication-assisted treatment for opioid use disorder with methadone (31%) or buprenorphine (15%). A clinical history of hazardous alcohol use was documented in 51%. Based on AUDIT-C, 14% of 527 patients with ACASI interview data available had evidence of current hazardous alcohol use. The majority were prescribed antiretroviral therapy (93%), but only 78% had HIV suppression to <400 copies/mL. Most were infected with HCV genotype 1 (96%), and 24% had evidence of advanced fibrosis/cirrhosis by FIB-4. The majority were insured through the Maryland Medicaid program (51%).

Most (92%) of the 593 people with HCV infection were referred for HCV care (including 22 individuals for whom HCV and HIV treatment was managed by the same clinician), and the majority (87%) attended at least 1 HCV care appointment (Figure 1). The median number of scheduled HCV appointments before successful attendance (range) was 2 (1–16). Of the 593 patients with active HCV infection, 77% were prescribed and 72% initiated HCV therapy. Overall, SVR was documented in 87% of the 426 people who initiated HCV treatment. Among 56 patients for whom SVR was not documented, 36 completed treatment and had an undetectable viral load after EOT but did not return for SVR12 assessment, 17 stopped therapy prematurely or did not follow up with care, and 3 had probable HCV relapse post-treatment. An additional 2 had evidence of HCV reinfection (Supplementary Table 1) and were subsequently re-treated and cured. At the end of the study period, 370 people (62%) achieved HCV cure.

In univariable analysis, older age, higher CD4 counts, previous HCV treatment, and advanced liver disease (stage ≥F2 compared with F0–F1) were positively associated with HCV treatment initiation (Table 2). Conversely, female sex, a detectable (>400 copies/mL) HIV RNA, and a higher proportion of missed visits were negatively associated with HCV treatment initiation. Being insured by Medicaid compared with Medicare was also negatively associated with HCV treatment initiation. Among the 298 Medicaid-insured patients, 192 (64%) initiated HCV treatment, compared with 234 (79%) patients insured through Medicare or private insurance ($P < .0001$). Among the 31 patients prescribed but who did not initiate HCV therapy, 22 (71%) were insured by Medicaid. A history of injection drug use and a recent history of illicit substance use were both negatively associated with HCV therapy initiation. Recent hazardous alcohol use was not significantly associated with HCV treatment initiation.

In multivariable analysis, advanced liver disease (hazard ratio [HR], 1.48; 95% confidence interval [CI], 1.17–1.88) remained significantly positively associated with HCV treatment initiation. Conversely, being insured by Medicaid (HR, 0.75; 95% CI, 0.61–0.92), having a detectable HIV RNA (HR, 0.29; 95% CI, 0.18–0.49), and having a higher proportion of missed HIV care visits remained significantly negatively associated with HCV treatment initiation. Similar results were found when the number of missed HIV care visits was evaluated

Table 1. Characteristics of Participants at First HIV Care Visit (2013–2016)

Characteristic	No.	No. (%) or Median (IQR)
Age, y	593	53.9 (49.8–58.1)
Male sex	593	400 (67.5)
African American race	593	529 (89.2)
CD4 T-cell count, cells/mm^3	590	
<200		80 (13.6)
200–350		118 (20.0)
>350		392 (66.4)
HIV RNA copies/mL	590	20 (20, 87)
On antiretroviral therapy	593	553 (93.3)
On antiretroviral therapy and RNA <400 copies/mL	590	460 (78.0)
HIV transmission risk	593	
IDU		430 (72.5)
MSM		65 (11.0)
Heterosexual		312 (52.6)
Ever alcohol abuse	593	303 (51.1)
Recent hazardous alcohol use (AUDIT-C)[a]	527	
No		456 (86.5)
Yes		71 (13.5)
Recent drug use (past 3 mo)	527	
None (includes marijuana)		420 (79.7)
Recent illicit drug use		107 (20.3)
Methadone use	593	182 (30.7)
Buprenorphine use	593	86 (14.5)
Tobacco use	593	516 (87.0)
Any prior psychiatric diagnosis	593	344 (58.0)
History of diagnosed depression	593	241 (40.6)
HCV genotype	559	
1a		419 (75.0)
1b		118 (21.1)
Other		22 (4.0)
FIB-4 score	585	
<1.45		152 (26.0)
1.45–3.24		291 (49.7)
≥3.25		142 (24.3)
Fibrosis stage[b]	368	
Stage F0–F1		163 (44.3)
Stage ≥F2		205 (55.7)
Platelet count <150 000	586	154 (26.3)
Estimated creatinine clearance <30	548	18 (3.3)
Previous hepatitis C treatment	593	121 (20.4)
Insurance	584	
Medicaid		297 (50.9)
Medicare		228 (39.0)
Private		55 (9.4)
Other public insurance		4 (0.7)
Proportion of scheduled visits that were missed[c]	593	
0%		472 (79.6)
1%–24%		0
25%–49%		11 (1.9)
≥50%		110 (18.6)

Abbreviations: AUDIT-C, Alcohol Use Disorders Identification Test; FIB-4, Fibrosis-4; HCV, hepatitis C virus; IDU, injection drug use; IQR, interquartile range; MSM, men who have sex with men.

[a]Recent hazardous alcohol use was defined as a score of ≥4 for men and ≥3 for women on the AUDIT-C, collected by audio computer-assisted interview software at the first study visit after entry into the cascade between 2013 and 2016.

[b]Fibrosis stage of F0–F1 was defined based on noninvasive testing score cutoffs of a fasting liver stiffness measurement of ≤7.9 KPA or FibroTest of <0.48, and ≥F2 was defined as a fasting liver stiffness measurement of >7.9 KPA or FibroTest of ≥0.48. Data were available on 368 of 593 patients.

[c]Proportion of missed HIV visits of total scheduled HIV visits starting 1 year before first HIV visit.

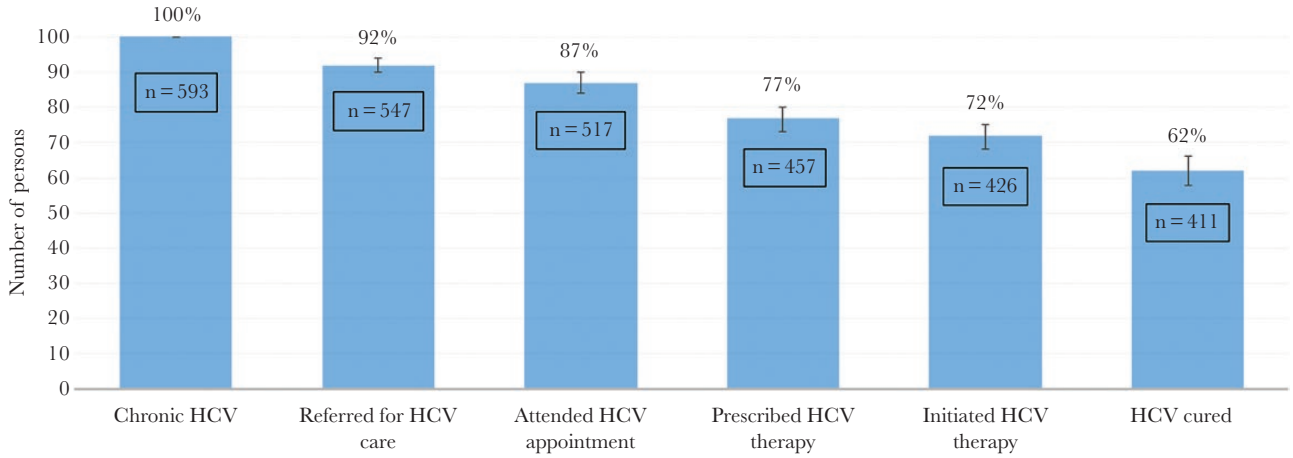

Figure 1. Hepatitis C virus (HCV) care continuum among HIV/HCV-infected patients in an urban HIV clinic.

(Supplementary Table 2). Participants with poor engagement in HIV care, defined by missed visits, were less likely to have HIV viral suppression (48.7% vs 81.7%; $P < .0001$) and more likely to report recent illicit drug use (37.0% vs 19.4%; $P = .03$) (Supplementary Table 3).

During the study period, 30 deaths occurred among 593 individuals before HCV treatment initiation (5.2%; mortality rate, 18.6 per 1000 person-years), including 10 liver related deaths (33.3%), 13 non-liver-related deaths (43.3%), and 7 with unknown causes of death (23.3%) (Supplementary Table 4).

DISCUSSION

People with HIV have been identified as a population in which micro-elimination of HCV should be prioritized. In this large, urban cohort of predominantly African American patients with HIV and HCV coinfection and high rates of polysubstance use, we observed significant improvements in progress through the HCV care continuum, compared with our previous observation during the interferon era, in which only 3% of people with active HCV infection initiated therapy and <1% were cured [7]. With respect to the WHO 2030 target for HCV diagnosis, nearly all people in our HIV clinic are tested for HCV antibody at least once, exceeding the WHO target of 90%. On the other hand, the rate of HCV treatment in our population (72%) remains below the WHO target of 80% of eligible people treated [24]. In this regard, our study provides important insight into ongoing barriers to HCV treatment and elimination.

In the DAA era, we found that 92% of PWH with active HCV infection were referred and 87% attended HCV care appointments, which represent dramatic improvements compared with the interferon era, when only one-third of people were referred and even fewer (22%) attended HCV care appointments [7]. Rates of HCV treatment initiation did not vary significantly by race, contrasting with a previous study in this cohort, which found that nonblack race, compared with black race, was associated with 2.5 times the odds of HCV treatment initiation [25]. The finding of lower rates of HCV treatment initiation among females observed in our unadjusted models is concerning and has been reported in other studies [26, 27]. The negative association of HCV treatment initiation with female sex fell short of statistical significance in the adjusted model, likely due to our sample size and limited power to detect the observed adjusted effect size. This potential HCV treatment disparity based on gender is deserving of further evaluation and intervention.

Our data indicate that the majority of PWH who initiate HCV treatment in our practice achieve cure. This is consistent with SVR rates achieved in other real-world and clinical trial settings [28–37].

Based on our findings, the step in the HCV care continuum where there is considerable room for improvement is access to HCV treatment and, for some PWH, engagement in HIV care. During the study period, Maryland Medicaid restricted access to DAAs due to the high cost of these treatments. Drug use was removed as a restriction in 2016. The restriction of therapy to people with evidence of METAVIR stage ≥2 fibrosis, however, continued until 2018. Not surprisingly, we found that people with minimal liver disease and state Medicaid insurance were less likely to be treated. In fact, as 71% of those for whom medication was prescribed but not started were on Medicaid, removal of this barrier alone would be expected to improve treatment uptake above the 80% elimination target. Fortunately, for our population, this barrier was remedied by a change in Maryland Medicaid policy in October 2018, which provides DAA coverage for all PWH and HCV. However, access to DAAs for many PWH with HCV remains restricted in other states in the United States and many other parts of the world.

Our findings underscore the reality that the system-level barriers, such as restriction to HCV treatment based on liver fibrosis stage, alcohol use, drug use, or other factors, represent

Table 2. Factors Associated With HCV Treatment Initiation by Participant Characteristics

Characteristic	Crude Hazard Ratio (95% CI)	Adjusted Hazard Ratio (95% CI)
Characteristics at first HIV visit		
Sex		
Male	1	1
Female	0.72 (0.59–0.89)	0.85 (0.69–1.05)
Race		
African American	1.0	1.0
Other	0.89 (0.64–1.23)	1.04 (0.73–1.47)
HIV transmission risk		
IDU		
No	1.0	
Yes	0.80 (0.65–0.98)	
MSM		
No	1.0	
Yes	1.26 (0.94–1.69)	
Heterosexual		
No	1.0	
Yes	0.95 (0.79–1.15)	
Tobacco use		
No	1.0	
Yes	0.80 (0.61–1.04)	
Depression		
Never	1.0	
Ever	0.92 (0.76–1.12)	
HCV genotype		
1a	1.0	
1b	1.03 (0.82–1.31)	
Other	0.57 (0.31–1.04)	
Fibrosis stage[b]		
Stage F0–F1	1.0	1.0
Stage ≥F2	1.50 (1.19–1.89)	1.48 (1.17–1.88)
Missing	0.77 (0.60–0.98)	0.77 (0.60–0.99)
Previous hepatitis C treatment		
No	1.0	
Yes	1.64 (1.31–2.06)	
Insurance		
Medicare	1.0	1.0
Medicaid	0.64 (0.52–0.79)	0.75 (0.61–0.92)
Other	0.90 (0.65–1.25)	0.96 (0.69–1.34)
Time-varying covariates		
Age, y		
<50	1.0	1.0
≥50	1.41 (1.12–1.77)	1.09 (0.85–1.39)
CD4 T-cell count		
<200	1.0	
200–350	1.57 (1.05–2.34)	
>350	1.72 (1.21–2.44)	
On antiretroviral therapy and RNA <400		
Yes	1.0	1.0
No	0.24 (0.15–0.40)	0.29 (0.18–0.49)
Recent (past 3 mo) drug use		
None (includes marijuana)	1.0	1.0
Illicit drug use	0.71 (0.54–0.92)	0.83 (0.63–1.09)
Missing	0.75 (0.52–1.09)	0.95 (0.64–1.42)
Recent hazardous alcohol use (AUDIT-C)[a]		
No	1.0	
Yes	0.97 (0.71–1.32)	

Table 2. Continued

Characteristic	Crude Hazard Ratio (95% CI)	Adjusted Hazard Ratio (95% CI)
Missing	0.80 (0.55–1.15)	
Proportion of missed HIV visits[c]		
0%	1.0	1.0
1%–24%	0.63 (0.48–0.84)	0.72 (0.54–0.97)
25%–49%	0.51 (0.38–0.68)	0.66 (0.49–0.89)
≥50%	0.28 (0.18–0.42)	0.39 (0.25–0.60)

Abbreviations: AUDIT-C, Alcohol Use Disorders Identification Test; CI = confidence interval; FIB-4, Fibrosis-4; HCV, hepatitis C virus; IDU, injection drug use; IQR, interquartile range; MSM, men who have sex with men.

[a]Recent hazardous alcohol use was defined as a score of ≥4 for men and ≥3 for women on the AUDIT-C, collected by audio computer-assisted interview software at study visits.

[b]Fibrosis stage of F0–F1 was defined based on noninvasive testing score cutoffs of a fasting liver stiffness measurement of ≤7.9 KPA or FibroTest of <0.48, and ≥F2 was defined as a fasting liver stiffness measurement of >7.9 KPA or FibroTest of ≥0.48. Data were available on 368 of 593 patients.

[c]Proportion of missed HIV visits of total scheduled HIV visits starting 1 year before the first HIV visit.

a major threat to achievement of HCV elimination goals [38]. Not only do these restrictions impact the ability to treat and cure patients with HCV at critical points in their care trajectory, they also send a message that HCV treatment is not important and should not be considered a priority. As illustrated in our study, with a high proportion of liver-related deaths before HCV treatment initiation, these delays in HCV treatment often result in avoidable liver-related mortality. In addition to factors related to treatment access, failure to initiate HCV treatment was strongly linked to measures of inadequate engagement in HIV care. This highlights poor retention in HIV care of a subset of PWH [39]. The most recent estimates of progress through the HIV care continuum in the United States suggest that of the 1.1 million PWH, 85% are linked to care and 49% have an undetectable HIV viral load [40]. Missed HIV primary care visits demonstrated a strong dose–response relationship with failure to initiate HCV treatment in this study, and this factor has been associated with HIV treatment failure, lack of retention in HIV care, and mortality in other studies [23, 41–43]. Similarly, having an HIV viral load that was not suppressed on ART was associated with a lower risk of HCV treatment initiation. These markers of lack of engagement in HIV care have previously been associated with nonreferral for HCV treatment [44]. These data suggest that for HCV micro-elimination to be achievable for PWH, efforts will be required to improve HIV care engagement. A key measure of this engagement is attainment of the HIV 90-90-90 targets: 90% of PWH started on ART, of whom 90% achieve viral suppression. Although we have >93% of our cohort on antiretroviral therapy, consistent with national findings, only 78% are virally suppressed.

Our finding of HCV treatment cure rates that fall short of the WHO HCV treatment coverage goals, overlaid with HIV viral suppression rates that fall short of the HIV 90-90-90 targets, suggest that interventions that facilitate progress through both the HIV and HCV care continua are essential to achievement of both the HIV 90-90-90 goals and WHO HCV elimination goals among PWH. These interventions will also need to address the engagement and HCV treatment needs of PWH who are not engaged in HIV care and are thus likely harder to treat for HCV. The HIV care engagement needs of people who use drugs (PWUD) and HCV care engagement needs of women who may be less likely to link to and initiate HCV treatment should also be taken into consideration. Potential interventions include integration of substance use, HIV and HCV care, treatment of HCV by all HIV care providers and nonspecialist providers, and treatment in nontraditional settings, such as mobile vans or community-based organizations, where hard-to-reach populations such as HIV-infected and uninfected PWUD may be more likely to access and complete the relatively short course of HCV treatment.

Our study is limited by being a single clinical site study in a setting where a clear and shared goal for HCV treatment of all HCV/HIV-coinfected patients has been articulated and a plan to overcome known barriers to progress through the HCV care continuum has been implemented. This, on the other hand, is also a strength of our study, as it highlights the possibilities for progress through the HCV care continuum, including reduction in racial disparities in access to HCV treatment, while also showcasing ongoing barriers to HCV treatment initiation in the oral DAA era. Our cohort is not representative of all PWH, as we only capture PWH receiving HIV care in our analysis. Cohorts consisting predominantly of HIV-infected men who have sex with men in other countries have reported higher rates of HCV cure, which may be related to a combination of differences in health systems and access to HCV therapies in different countries and differences in the level of criminalization of people who use drugs relative to other populations [45]. Additionally, due to the clinical nature of our cohort, we may have incomplete ascertainment of HCV infection status, as it is possible that patients may have acquired incident HCV infection or reinfection since previous HCV testing that may have been missed. Our population was also predominantly African American and likely acquired HCV through injection drug use. We also only had recent substance and hazardous alcohol use data in a subset of the study population and were unable to ascertain cause of death in all cases.

In summary, we found significant improvements in progress through the HCV care continuum in a large urban cohort of HIV/HCV-coinfected patients. Although encouraging, several barriers to achievement of the WHO service targets for HCV treatment persist. Economic and structural barriers to HCV treatment remain in the United States and many other regions. Strategies to improve engagement of PWH in HIV care will be critical to achieve HCV elimination in HIV-infected populations.

Supplementary Data

Supplementary materials are available at *Open Forum Infectious Diseases* online. Consisting of data provided by the authors to benefit the reader, the posted materials are not copyedited and are the sole responsibility of the authors, so questions or comments should be addressed to the corresponding author.

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