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## Unhealthy Alcohol and Illicit Drug Use are Associated with Decreased Quality of HIV Care

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### Abstract

**Background**—HIV-infected patients with substance use experience suboptimal health outcomes, possibly to due to variations in care.

**Objectives**—To assess the association between substance use and the quality of HIV care (QOC) received.

**Research Design**—Retrospective cohort study.

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**Conflicts of Interest:** The authors have no conflicts of interest to declare.

**Subjects**—HIV-infected patients enrolled in the Veterans Aging Cohort Study.

**Measures**—We collected self-report substance use data and abstracted 9 HIV quality indicators (QIs) from medical records. Independent variables were unhealthy alcohol use (AUDIT-C score 4) and illicit drug use (self-report of stimulants, opioids, or injection drug use in past year). Main outcome was the percentage of QIs received, if eligible. We estimated associations between substance use and QOC using multivariable linear regression.

**Results**—The majority of the 3,410 patients were male (97.4%) and Black (67.0%) with a mean age of 49.1 years (SD 8.8). Overall, 25.8% reported unhealthy alcohol use, 22% illicit drug use, and participants received 81.5% (SD=18.9) of QIs. The mean percentage of QIs received was lower for those with unhealthy alcohol use vs. not (59.3% vs. 70.0%,  $p<.001$ ) and those using illicit drugs vs. not (57.8% vs. 70.7%,  $p<.001$ ). In multivariable models, unhealthy alcohol use (adjusted  $\beta$  -2.74; 95% CI -4.23, -1.25) and illicit drug use (adjusted  $\beta$  -3.51 95% CI -4.99, -2.02) remained inversely associated with the percentage of QIs received.

**Conclusions**—Though the overall QOC for these HIV-infected Veteran patients was high, gaps persist for those with unhealthy alcohol and illicit drug use. Interventions that address substance use in HIV-infected patients may improve the QOC received.

### Keywords

Alcohol; Quality of Health Care; HIV; Quality Indicators; Health Care; Opioid-Related Disorders

## INTRODUCTION

Combined antiretroviral treatment (cART) use has increased survival among HIV-infected patients from a few years to decades<sup>1-2</sup>. This has transformed treatment of HIV disease into the management of a chronic illness. As with other chronic illnesses (e.g., diabetes and heart failure), national guidelines have been proposed to promote evidence-based management of HIV-infection and prevention of HIV-related complications and associated conditions<sup>3-4</sup>. The 2010 U.S. National HIV/AIDS Strategy identifies improving the quality of care for persons living with HIV as a national priority<sup>5</sup>. Consensus is emerging for national standards to measure the quality of HIV care received using a uniform set of quality indicators (QI)<sup>6</sup>.

The Institute of Medicine reviewed guidelines intended to improve the quality of care for HIV-infected individuals and recommended measuring the quality of care in vulnerable populations such as those who abuse substances<sup>7</sup>. Unhealthy alcohol use and illicit drug use are prevalent among HIV-infected patients. The quality of HIV care received may be lower for HIV-infected patients with injection drug use<sup>8</sup>, opioid dependence<sup>9</sup>, and illicit drug use<sup>10</sup>. Though HIV-infected individuals are particularly susceptible to the harms of unhealthy consumption, little is known about the effect of unhealthy alcohol use (defined by quantity criterion of >14 and >7 drinks per week, or >5 drink and >4 drinks per occasion in the last year, for males and females, respectively) on the quality of HIV care received. A few studies, however, have reported unhealthy alcohol use to be associated with suboptimal receipt of antiretroviral therapy, antiretroviral adherence and outcomes<sup>11-13</sup>. Furthermore, treatment of substance use disorders may improve the quality of HIV care received, but few patients access treatment<sup>14-15</sup>. In a recent study of HIV-infected patients with opioid dependence, improving access to treatment with office-based buprenorphine increased the percentage of recommended HIV care indicators received<sup>9</sup>. Thus, the effects of alcohol and drug use on quality of care are likely modifiable and quantification of their impact is an important step toward identifying appropriate interventions to improve quality of care.

Early studies suggest that the quality of HIV care received is generally high for HIV-infected populations receiving care in a large integrated health care system<sup>16</sup> and the Veterans Health Administration (VHA)<sup>8, 10</sup>. The VA health care system underwent an extensive systems re-engineering in the mid-1990's that improved the quality of care for Veterans, overall<sup>17</sup>. Assessment of HIV-specific National Quality Forum QIs demonstrates these benefits have extended to the VHA's more than 40,000 HIV-infected Veterans each year, as well<sup>10</sup>. Although this study revealed mixed associations between ever having used illicit drugs and individual quality indicators, it did not focus on Veterans with current (past year) substance use and was limited by its reliance on past medical visit ICD-9 codes for opiate, cocaine, or amphetamine use. Addressing current alcohol and illicit drug use may improve the number of quality indicators met, thereby improving the overall quality of care provided to this vulnerable population.

The objective of the current study is to assess the impact of current (past year) unhealthy alcohol consumption and illicit drug use on the quality of HIV care received in HIV-infected Veterans. We hypothesized that quality of HIV care received would be lower among HIV-infected patients with unhealthy alcohol and illicit drug use, compared to those without use.

## METHODS

### Setting & Participants

We conducted a cross-sectional analysis of quality indicators among HIV-infected patients enrolled in the Veterans Aging Cohort Study (VACS), which is an ongoing, enrolling study that has been described previously<sup>18-19</sup>. Briefly, VACS is a cohort study of HIV-infected patients receiving care at 8 VHA infectious disease clinics, and age, race, and site matched HIV uninfected patients enrolled in general medicine clinics. This analysis includes participant baseline data from start of enrollment in June 2002 to July 2008. VACS clinic sites are located at Veterans Health Administration (VHA) facilities in Atlanta, GA; Baltimore, MD; Bronx, NY; Houston, TX; Los Angeles, CA; New York City, NY; Pittsburgh, PA; and Washington, DC. VACS is IRB approved at the coordinating center at the VA Connecticut Healthcare System and the VA and university affiliates of participating sites. At baseline enrollment, participants completed baseline surveys and provided permission to access all their information within the VHA, including medication, laboratory, pharmacy, diagnostic, and utilization data. Six follow-up surveys have been administered to date at approximately yearly intervals. We used data from the baseline survey and administrative data for this analysis.

### Measures

We measured 9 individual QIs from therapeutic (cART, *Pneumocystis jirovecii* [PCP] & *Mycobacterium avium* complex [MAC] prophylaxis from medication data, if eligible in the 12 months after baseline), monitoring (at least 2 CD4 tests per year at least 90 days apart, and at least 2 HIV clinic visits per year at least 90 days apart in the 12 months after baseline), screening (any Hepatitis C [HCV] antibody or RNA quantitative PCR testing in the 12 months after or any time prior to baseline ("ever"), and lipid screening in the 12 months after baseline), and prevention (pneumococcal vaccine in the 12 months after or any time prior to baseline ("ever"), and influenza vaccine in the 12 months after baseline) quality domains (Table 1). QIs were only assessed if a patient was eligible to receive the indicated care process (e.g. the cART QI was only considered "met" if the participant's CD4 count nadir was < 350 cells/mL<sup>3</sup>). Participants were eligible to receive as few as 5 and as many as 9 QIs. These QIs were originally developed according to modified Delphi methods for use in the HIV Cost and Utilization Study and RAND<sup>20</sup>, adapted for use in the VA<sup>8, 10, 21</sup>,

reviewed in an Institute of Medicine Report,<sup>7</sup> and recently adopted as a set of national consensus panel quality indicators for HIV care<sup>6</sup>.

The primary outcome measure for this analysis was the percentage of QIs each participant received, if eligible, as previously used to estimate the overall quality of healthcare in the United States<sup>22</sup> and adapted for HIV-infected populations<sup>9</sup>. For example, if 6 QIs were met for a person who was eligible to receive 9, that person received 66.6% ( $6/9 \times 100$ ) of the QIs for which he or she was eligible. Secondary outcome measures included each of the individual QIs (Table 1).

The main independent variables were self-reported unhealthy alcohol use and illicit drug use from the baseline survey. Unhealthy alcohol use in the past 12 months (recent use) was defined by the three-item Alcohol Use Disorders Identification Test-Consumption (AUDIT-C) score greater than or equal to 4<sup>23</sup>, which includes at-risk drinking, alcohol abuse, and dependence<sup>24</sup>. This instrument is a universal, annual screening measure for Veterans in primary care clinics, prompts assessment for risky alcohol use, and has been used as a measure of unhealthy alcohol use in a variety of patient populations. Illicit drug use in the past 12 months was defined by any self-reported use of stimulants, opioids, or injection drugs in past year<sup>25-26</sup>.

### Covariates

Covariates included gender (male, female), race/ethnicity (White, Black, Latino, Other), age in years, education level (at least a high school graduate or GED vs. less), periods of homelessness (ever vs. never), and VACS clinic site. We assessed comorbid conditions including hepatitis C (HCV) antibody positive (yes/no) from laboratory data and ICD-9 codes, diabetes diagnosis (yes/no) from ICD-9 codes, laboratory, and pharmacy data, and depressed mood based on participant-reported Prime MD Patient Health Questionnaire (PHQ-9) score greater than 10 from the VACS baseline survey<sup>27-28</sup>.

### Analysis

Patient characteristics and individual QIs are described overall and by unhealthy alcohol use (yes/no) and recent illicit drug use (yes/no). Continuous variables (age) were compared using t-tests and categorical variables were compared using chi-square tests. We estimated associations between unhealthy alcohol and illicit drug use and the mean percentage of QIs received using bivariate and multivariable linear regression. All covariates were examined in bivariate models. Covariates were included in multivariable models if significant at  $p < 0.20$  in bivariate analysis or based on *a priori* hypotheses. Multivariable models were adjusted for site by including site as a covariate in the models. Variance inflation factors were examined to identify whether there were issues with collinearity.

We conducted several sensitivity analyses. Since the distribution of the primary outcome variable of percentage of QIs received was non-normal, we considered alternative dependent variables, e.g. dichotomizing the percentage of QIs received at an arbitrary level 80% (yes/no). Use of a dichotomous variable did not alter the association between substance use and quality of care in multivariable analysis. Furthermore, the clinical meaningfulness of an 80% QIs received threshold is unknown. We consequently retained the continuous measure for ease of communicating results. We also assessed the role of HIV clinic visits in driving the results by repeating multivariable analyses limited to only participants with 2 or more HIV clinic visits. This approach did not substantially alter the results of the original model. Stata/SE version 11.0 (StataCorp, College Station, Texas) was used to perform all statistical analyses.

## RESULTS

The majority of 3,410 HIV-infected participants were male (97.4%), Black (67.0%) and had completed a high school education or GED (58.7%); mean age was 49.1 years (SD 8.8) (Table 2). Eighty-three percent were prescribed HIV antiretroviral medications, 75.9% had a CD4 count greater than 200 cells/mL<sup>3</sup>, and 49.1% had an undetectable HIV viral load. Substance use was prevalent, with 25.8% reporting unhealthy alcohol use, 29.1% reporting illicit drug use, and 11.5% reporting both unhealthy alcohol and illicit drug use in past year. Marijuana (27.7%) and cocaine (21.9%) were the most frequently used drugs, and 7.1% reported injection drug use in the past year. Participants with unhealthy alcohol use were more frequently male, younger, homeless, depressed, and HCV-infected, and less frequently had diabetes, a high school education, prescribed cART, or an undetectable HIV viral load compared with those without unhealthy alcohol use. Participants with illicit drug use were more frequently ever homeless, had depressed mood, and HCV-infected, and less frequently had diabetes, a high school education, prescribed cART, or an undetectable HIV viral load compared with those without illicit drug use.

Overall, HIV-infected patients received a mean 81.5% (Standard deviation [SD] 18.9) of HIV QIs for which they were eligible (Table 3). Mean QI completion was overall lower for those with vs. without recent unhealthy alcohol use (78.4% vs. 82.7%,  $p < .001$ ), and those with vs. without illicit drug use (77.7% vs. 83.1%,  $p < .001$ ). Participants with recent unhealthy alcohol use less frequently received CD4 cell count monitoring, at least 2 HIV visits per year, lipid screening, and influenza vaccinations compared with non-unhealthy users. Participants with recent illicit drug use less frequently received cART, but more frequently received PCP and MAC prophylaxis compared with non-users. They also less frequently received CD4 cell count monitoring, at least 2 HIV visits per year, lipid screening, and pneumococcal and influenza vaccinations compared with non-users.

Both recent unhealthy alcohol use (adjusted  $\beta$  coefficient [ $\beta$ ] -2.74; 95% CI -4.23, -1.25) and illicit drug use (adjusted  $\beta$  -3.51 95% CI -4.99, -2.02) were inversely associated with the percentage of QIs received, after adjusting for age, gender, race, a history of homelessness, diabetes, depressed mood, and site (Table 4). In addition, Black and Other race/ethnicity, homelessness, and depression were associated with lower quality of HIV care received. Quality of HIV care received was higher among participants age  $\geq$  50 years, those with diabetes, and for males compared with females.

## DISCUSSION

Overall, our data suggest that the quality of HIV care received by patients at these VA sites is high. Fulfilling of individual QI indicators (e.g., antiretroviral use and PCP prophylaxis) was comparable with that recently reported for large integrated healthcare systems<sup>10, 16</sup> and better than levels reported for Ryan White-funded clinics for several QIs<sup>9, 29</sup>. Gaps in quality of HIV care received persist, however, for patients with recent unhealthy alcohol and illicit drug use, as well as for HIV-infected Veterans with Black race/ethnicity, female gender, homelessness, and depression. Our study quantifies the magnitude of effect of unhealthy alcohol and illicit drug use on the quality of HIV care received and suggests that targeted interventions to improve the quality of care among these patients may be indicated.

Patients with unhealthy alcohol use in the past year, on average, received 4.3% fewer indicated HIV care processes than patients without unhealthy alcohol use. To our knowledge, our study is the first to report the effects of current unhealthy alcohol use on the quality of HIV care received. The effect of alcohol use on quality of care for other chronic illnesses is mixed. Massachusetts Medicaid clients with substance use, including alcohol,



were less likely to receive diabetes and asthma indicators<sup>30</sup>. In contrast, HCV-infected private insurance beneficiaries with alcohol use were more likely to receive seven HCV quality indicators compared with non-drinkers<sup>31</sup> and alcohol was not a predictor of receipt of care among National Health and Nutrition Examination Survey (NHANES) participants with severe hypertension<sup>32</sup>. Quality of acute myocardial infarction care was comparable for most quality indicators, but lower for receipt of beta blockers at discharge in those with vs. without alcohol-related diagnoses<sup>33</sup>. The mechanisms of observed disparities in quality of care for unhealthy alcohol users in the current study merit further investigation, but may include decreased patient engagement in HIV care (as evidenced by their decreased likelihood of attending 2 HIV clinic visits) and competing medical needs (as evidenced by increased HCV prevalence) that distract providers from addressing preventive care.

Patients with illicit drug use in the past year, on average, received 5.4% fewer indicated HIV care processes than patients without illicit drug use. This is consistent with prior studies demonstrating a lower proportion of QIs met for HIV-infected patients with hard drug use<sup>10</sup> and opioid dependence<sup>9</sup>. The percent of patients for whom individual QIs were met was mixed in the current study, with illicit drug users less likely to receive 6 of 9 QIs (including antiretroviral therapy) and more likely to receive 2 of 9 QIs (including PCP prophylaxis) compared with non-users. Similarly, Backus *et al.* reported mixed directions in receipt of care processes for U.S. military Veterans, with illicit drug users more likely to receive 4 of 10 QIs and more likely to receive 5 of 10 QIs<sup>10</sup>. Illicit drug users were less likely to receive potent antiretroviral therapy and there was non-significant trend toward greater receipt of PCP prophylaxis. The reasons for this divergence in receipt of medication-based QIs are unclear and merit further study. One hypothesis is that providers may be less likely to offer cART to drug users due to concerns about suboptimal adherence precipitating resistance, which is less important for PCP and MAC prophylaxis<sup>34</sup>. Evidence suggests there is no difference in antiretroviral resistance rates between HIV-infected drug users and non-users<sup>35</sup>.

The differences observed in quality of care for patients with and without substance abuse generates the hypothesis that interventions that increase engagement of HIV-infected patients with substance abuse may improve the quality of HIV care received. For example, substance use treatment in HIV-infected individuals is associated with improved ART adherence<sup>36</sup>, decreased emergency department visits and hospitalizations<sup>37</sup>, and increased receipt of primary care<sup>38</sup>, but substance use treatment is often underutilized.<sup>39–42</sup> In a recent study, opioid-dependent, HIV-infected patients receiving office-based buprenorphine/naloxone from their HIV providers experienced a 6% increase in average quality of care received over 12 months follow-up. Patients receiving buprenorphine had more visits with their HIV provider during follow-up and were more likely to improve QOC compared with those receiving other treatment<sup>9</sup>. Similarly, both patients with unhealthy alcohol use and those with recent illicit drug use in the current study were less likely to have at least 2 visits per year. Other non-addiction-specific interventions that increase adherence to HIV clinic visits may increase opportunities for receipt of indicated care processes, as well.

In our study, other groups besides substance users experienced important gaps in the quality of their HIV care. Black patients received fewer QIs than white patients, consistent with prior data suggesting decreased cART utilization in Black HIV-infected patients<sup>10, 43–44</sup>. VACS participants who reported a history of ever having been homeless received lower quality of care, on average, as well, consistent with prior studies suggesting substantial barriers to care for homeless individuals<sup>45–46</sup>. Depressed participants also received fewer QIs compared with non-depressed participants. Prior studies demonstrate suboptimal HIV outcomes for depressed patients<sup>47</sup> which can improve with depression treatment, particularly for those with substance abuse<sup>36</sup>. The VA has recently developed new QIs and

multidisciplinary care team interventions for depression care in HIV-infected Veterans<sup>48–49</sup>. Males received more QIs than females, a finding opposite of that observed in the U.S. population<sup>50</sup>. Relatively few HIV-infected females were included in our dataset, and female veterans likely represent a more vulnerable group compared with females in the general U.S. population<sup>51–53</sup>. Further studies that address reasons for and interventions to address disparities in the quality of HIV care received by patients of Black race/ethnicity, and those who are female, homeless or depressed are urgently needed. Since Black race/ethnicity, homelessness, and depression were also associated with increased substance use in our data, our multivariable findings may underestimate the negative association between substance use and quality of HIV care, as suggested by attenuation of effect size when these were included in the multivariable model (Table 4). HIV clinics in the VHA are well-positioned to serve as models for improving ongoing engagement in care for all patients with unhealthy alcohol and illicit drug use.

Patients with diabetes experienced increased quality of HIV care compared to those without. This may represent the overlap in the management of HIV and other chronic conditions. Influenza and pneumococcal vaccinations, for example, are indicated for both HIV-infection and diabetes; providers may benefit from increased awareness of the need for these in a patient with both conditions. Also, patients with both HIV and diabetes may require more frequent visits, increasing the opportunity to receive indicated care processes. Further research is required to assess the role of multiple comorbid chronic illnesses, which are highly prevalent in HIV-infected populations, on receipt of HIV quality of care indicators.

Our study findings should be interpreted with respect to several potential limitations. First, our sample of predominantly male U.S. military Veterans may have limited generalizability to other HIV-infected populations. VACS participants, however, received overall QI levels comparable to another large HIV-infected VHA sample and an analysis of quality of care in 13,064 HIV-infected Kaiser Permanente beneficiaries<sup>10, 16</sup>. Second, we were unable to measure some QIs due to limitations of medical record data collection and validation (e.g., high risk sexual behavior screening). Inclusion of these QIs in electronic medical record collection would facilitate assessment of such QIs for both clinical and research purposes. Third, we were unable to account for QIs delivered by non-VA providers. This is unlikely to bias results of most QIs (e.g., most HIV-infected Veterans fill prescription for cART at VA pharmacies), but may be important for QIs commonly delivered in non-VA settings (e.g., influenza vaccinations). Fourth, there is the possibility that missed or canceled clinic visits could result in not receiving QIs. While there is not a uniform indicator for missing or canceled clinic visits in the dataset, we are reassured by a sensitivity analysis that we conducted, limited to only participants with at least 2 visits, which did not change our findings. Finally, we did not collect data on provider or facility-level characteristics that might contribute to quality of HIV care received.

In summary, despite overall high levels of quality of care for HIV-infected patients in VHA care, gaps persist for those with unhealthy alcohol and illicit drug use and other vulnerable subgroups. As chronic illness management becomes an increasingly dominant aspect of HIV care, ongoing measurement of care processes and strategies to improve the quality of HIV care received become paramount. Our findings advance the National HIV/AIDS Strategy goal of improving care for persons living with HIV<sup>5</sup> by identifying populations that may particularly benefit from targeted quality improvement efforts. Effective interventions are likely multifaceted, team-based interventions that better integrate mental health and addiction treatment with HIV primary care<sup>9, 49, 54</sup>.



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## References

1. Moore RD, Keruly JC, Gebo KA, Lucas GM. An improvement in virologic response to highly active antiretroviral therapy in clinical practice from 1996 through 2002. *J Acquir Immune Defic Syndr.* 2005; 39(2):195–198. [PubMed: 15905736]
2. Schackman BR, Gebo KA, Walensky RP, et al. The lifetime cost of current human immunodeficiency virus care in the United States. *Med Care.* Nov; 2006 44(11):990–997. [PubMed: 17063130]
3. Aberg JA, Kaplan JE, Libman H, et al. Primary Care Guidelines for the Management of Persons Infected with Human Immunodeficiency Virus: 2009 Update by the HIV Medicine Association of the Infectious Diseases Society of America. *Clin Infect Dis.* Sep 1; 2009 49( 5):651–681. [PubMed: 19640227]
4. Panel on Antiretroviral Guidelines for Adults and Adolescents. Guidelines for the use of antiretroviral agents in HIV-1-infected adults and adolescents. Department of Health and Human Services; Oct 14. 2011 p. 1-167. Available at <http://www.aidsinfo.nih.gov/ContentFiles/AdultandAdolescentGL.pdf>
5. The White House Office of National AIDS Policy. National HIV AIDS Strategy for the United States. Jul. 2010 Available at <http://aids.gov/federal-resources/policies/national-hiv-aids-strategy/nhas.pdf>
6. Horberg MA, Aberg JA, Cheever LW, Renner P, O'Brien Kaleba E, Asch SM. Development of national and multiagency HIV care quality measures. *Clin Infect Dis.* Sep 15; 2010 51(6):732–738. [PubMed: 20715924]
7. Institute of Medicine. [Accessed 3/20/04, 2004.] Measuring what matters: Allocation, planning, and quality assessment for the Ryan White CARE Act. 2004. <http://www.iom.edu/report.asp?id=16325>
8. Korthuis PT. Quality of HIV Care within the Veterans Affairs Health System: A Comparison Using Outcomes from the HIV Cost and Services Utilization Study. *Journal of Clinical Outcomes Management.* Dec; 2004 11(12):765–774.
9. Korthuis PT, Fiellin DA, Fu R, et al. Improving adherence to HIV quality of care indicators in persons with opioid dependence: the role of buprenorphine. *J Acquir Immune Defic Syndr.* Mar 1; 2011 56( Suppl 1):S83–90. [PubMed: 21317600]
10. Backus LI, Boothroyd DB, Phillips BR, et al. National quality forum performance measures for HIV/AIDS care: the Department of Veterans Affairs' experience. *Arch Intern Med.* Jul 26; 2010 170(14):1239–1246. [PubMed: 20660844]
11. Azar MM, Springer SA, Meyer JP, Altice FL. A systematic review of the impact of alcohol use disorders on HIV treatment outcomes, adherence to antiretroviral therapy and health care utilization. *Drug Alcohol Depend.* Dec 1; 2010 112(3):178–193. [PubMed: 20705402]
12. Samet JH, Horton NJ, Meli S, Freedberg KA, Palepu A. Alcohol consumption and antiretroviral adherence among HIV-infected persons with alcohol problems. *Alcohol Clin Exp Res.* Apr; 2004 28(4):572–577. [PubMed: 15100608]
13. Palepu A, Horton NJ, Tibbetts N, Meli S, Samet JH. Uptake and adherence to highly active antiretroviral therapy among HIV-infected people with alcohol and other substance use problems: the impact of substance abuse treatment. *Addiction.* Mar; 2004 99(3):361–368. [PubMed: 14982549]
14. Korthuis PT, Josephs JS, Fleishman JA, et al. Substance abuse treatment in human immunodeficiency virus: the role of patient-provider discussions. *J Subst Abuse Treat.* Oct; 2008 35(3):294–303. [PubMed: 18329222]

15. Palepu A, Horton NJ, Tibbetts N, Meli S, Samet JH. Substance abuse treatment and hospitalization among a cohort of HIV-infected individuals with alcohol problems. *Alcoholism: Clinical & Experimental Research*. 2005; 29(3):389–394.
16. Horberg M, Hurley L, Towner W, et al. HIV quality performance measures in a large integrated health care system. *Aids Patient Care STDS*. Jan; 2011 25(1):21–28. [PubMed: 21214376]
17. Jha AK, Perlin JB, Kizer KW, Dudley RA. Effect of the transformation of the Veterans Affairs Health Care System on the quality of care.[see comment]. *N Engl J Med*. 2003; 348(22):2218–2227. [PubMed: 12773650]
18. Conigliaro J, Justice AC, Gordon AJ, Bryant K. Role of alcohol in determining human immunodeficiency virus (HIV)-relevant outcomes: A conceptual model to guide the implementation of evidence-based interventions into practice. *Med Care*. Aug; 2006 44(8 Suppl 2):S1–6. [PubMed: 16849963]
19. Justice AC, Dombrowski E, Conigliaro J, et al. Veterans Aging Cohort Study (VACS): Overview and description. *Med Care*. Aug; 2006 44(8 Suppl 2):S13–24. [PubMed: 16849964]
20. Gross PA, Asch SM, Kitahata MM, et al. Performance measures for guidelines on preventing opportunistic infections in patients infected with human immunodeficiency virus.[erratum appears in *Clin Infect Dis* 2000 May;30(5):841 Note: Bozzette SA [corrected to Bozzette SA]]. *Clin Infect Dis*. 2000; 30(1)
21. Feussner JR, Kizer KW, Demakis JG. The Quality Enhancement Research Initiative (QUERI): from evidence to action. *Med Care*. 2000; 38(6 Suppl 1):11–6. [PubMed: 10843265]
22. McGlynn EA, Asch SM, Adams J, et al. The quality of health care delivered to adults in the United States.[see comment]. *N Engl J Med*. 2003; 348(26):2635–2645. [PubMed: 12826639]
23. Bush K, Kivlahan DR, McDonell MB, Fihn SD, Bradley KA. The AUDIT alcohol consumption questions (AUDIT-C): an effective brief screening test for problem drinking. Ambulatory Care Quality Improvement Project (ACQUIP). Alcohol Use Disorders Identification Test. *Arch Intern Med*. Sep 14; 1998 158(16):1789–1795. [PubMed: 9738608]
24. Saitz R. Clinical practice. Unhealthy alcohol use. *N Engl J Med*. Feb 10; 2005 352(6):596–607. [PubMed: 15703424]
25. Centers for Disease Control and Prevention. Core measures for HIV/STD risk behavior and prevention. Sexual Behavior and Drug Behavior Questions, Versions 4 & 5. Atlanta: Centers for Disease Control and Prevention; 2002.
26. Green TC, Kershaw T, Lin H, et al. Patterns of drug use and abuse among aging adults with and without HIV: a latent class analysis of a US Veteran cohort. *Drug Alcohol Depend*. Aug 1; 2010 110(3):208–220. [PubMed: 20395074]
27. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med*. Sep; 2001 16(9):606–613. [PubMed: 11556941]
28. Spitzer RL, Kroenke K, Williams JB. Validation and utility of a self-report version of PRIME-MD: the PHQ primary care study. Primary Care Evaluation of Mental Disorders. Patient Health Questionnaire. *JAMA*. Nov 10; 1999 282(18):1737–1744. [PubMed: 10568646]
29. Landon BE, Wilson IB, McInnes K, et al. Effects of a quality improvement collaborative on the outcome of care of patients with HIV infection: the EQHIV study.[see comment]. *Ann Intern Med*. 2004; 140(11):887–896. [PubMed: 15172903]
30. Clark RE, Weir S, Ouellette RA, Zhang J, Baxter JD. Beyond health plans: behavioral health disorders and quality of diabetes and asthma care for Medicaid beneficiaries. *Med Care*. May; 2009 47(5):545–552. [PubMed: 19319000]
31. Kanwal F, Schnitzler MS, Bacon BR, Hoang T, Buchanan PM, Asch SM. Quality of care in patients with chronic hepatitis C virus infection: a cohort study. *Ann Intern Med*. Aug 17; 2010 153(4):231–239. [PubMed: 20713791]
32. Hyman DJ, Pavlik VN. Characteristics of patients with uncontrolled hypertension in the United States. *N Engl J Med*. Aug 16; 2001 345(7):479–486. [PubMed: 11519501]
33. Fiellin DA, O'Connor PG, Wang Y, Radford MJ, Krumholz HM. Quality of care for acute myocardial infarction in elderly patients with alcohol-related diagnoses. *Alcoholism: Clinical & Experimental Research*. Jan; 2006 30(1):70–75.

34. Ding L, Landon BE, Wilson IB, Wong MD, Shapiro MF, Cleary PD. Predictors and consequences of negative physician attitudes toward HIV-infected injection drug users. *Arch Intern Med.* 2005; 165(6):618–623. [PubMed: 15795336]
35. Wood E, Hogg RS, Yip B, et al. Rates of antiretroviral resistance among HIV-infected patients with and without a history of injection drug use. *AIDS.* Jul 22; 2005 19(11):1189–1195. [PubMed: 15990572]
36. Turner BJ, Laine C, Cosler L, Hauck WW. Relationship of gender, depression, and health care delivery with antiretroviral adherence in HIV-infected drug users. *J Gen Intern Med.* 2003; 18(4): 248–257. [PubMed: 12709091]
37. Turner BJ, Laine C, Yang CP, Hauck WW. Effects of long-term, medically supervised, drug-free treatment and methadone maintenance treatment on drug users' emergency department use and hospitalization. *Clin Infect Dis.* 2003; 37(5):15.
38. Messeri PA, Abramson DM, Aidala AA, Lee F, Lee G. The impact of ancillary HIV services on engagement in medical care in New York City. *AIDS Care.* 2002; 14(1)
39. Burnam MA, Bing EG, Morton SC, et al. Use of mental health and substance abuse treatment services among adults with HIV in the United States. *Arch Gen Psychiatry.* 2001; 58(8):729–736. [PubMed: 11483138]
40. Palepu A, Raj A, Horton NJ, Tibbetts N, Meli S, Samet JH. Substance abuse treatment and risk behaviors among HIV-infected persons with alcohol problems. *J Subst Abuse Treat.* 2005; 28(1): 3–9. [PubMed: 15723726]
41. Palepu A, Tyndall MW, Joy R, et al. Antiretroviral adherence and HIV treatment outcomes among HIV/HCV co-infected injection drug users: the role of methadone maintenance therapy. *Drug Alcohol Depend.* 2006; 84(2):188–194. [PubMed: 16542797]
42. Korthuis PT, Josephs JS, Fleishman JA, et al. Substance Abuse Treatment in HIV: The Role of Patient-Provider Discussions. *J Subst Abuse Treat.* 2008; 35(3):294–303. [PubMed: 18329222]
43. Andersen RM, Bozzette SA, Shapiro MF, et al. Access of vulnerable groups to antiretroviral therapy among persons in care for HIV disease in the United States. HCSUS Consortium. HIV Cost and Services Utilization Study. *Health Serv Res.* 2000; 35(2):389–416. [PubMed: 10857469]
44. Gebo KA, Fleishman JA, Conviser R, et al. Racial and gender disparities in receipt of highly active antiretroviral therapy persist in a multistate sample of HIV patients in 2001. *J Acquir Immune Defic Syndr.* Jan 1; 2005 38(1):96–103. [PubMed: 15608532]
45. Douaihy A, Stowell K, Bui T, Daley D, Salloum I. HIV/AIDS and homelessness, Part 1: background and barriers to care. *The AIDS reader.* 2005; 15(10):516. [PubMed: 16265767]
46. Gelberg L, Andersen RM, Leake BD. The behavioral model for vulnerable populations: application to medical care use and outcomes for homeless people. *Health Serv Res.* 2000; 34(6): 1273–1302. [PubMed: 10654830]
47. Bouhnik A-D, Preau M, Vincent E, et al. Depression and clinical progression in HIV-infected drug users treated with highly active antiretroviral therapy. *Antiviral Therapy.* 2005; 10(1):53–61. [PubMed: 15751763]
48. Pyne JM, Asch SM, Lincourt K, et al. Quality indicators for depression care in HIV patients. *AIDS Care.* Oct; 2008 20(9):1075–1083. [PubMed: 18825515]
49. Pyne JM, Fortney JC, Curran GM, et al. Effectiveness of collaborative care for depression in human immunodeficiency virus clinics. *Arch Intern Med.* Jan 10; 2011 171(1):23–31. [PubMed: 21220657]
50. Asch SM, Kerr EA, Keesey J, et al. Who is at greatest risk for receiving poor-quality health care? *N Engl J Med.* 2006; 354(11):1147–1156. [PubMed: 16540615]
51. Haskell SG, Ning Y, Krebs E, et al. Prevalence of painful musculoskeletal conditions in female and male veterans in 7 years after return from deployment in Operation Enduring Freedom/ Operation Iraqi Freedom. *Clin J Pain.* Feb; 2012 28(2):163–167. [PubMed: 21677563]
52. Wright SM, Craig T, Campbell S, Schaefer J, Humble C. Patient satisfaction of female and male users of Veterans Health Administration services. *J Gen Intern Med.* Mar; 2006 21( Suppl 3):S26–32. [PubMed: 16637941]

53. Dobie DJ, Kivlahan DR, Maynard C, Bush KR, Davis TM, Bradley KA. Posttraumatic stress disorder in female veterans: association with self-reported health problems and functional impairment. *Arch Intern Med.* Feb 23; 2004 164(4):394–400. [PubMed: 14980990]
54. Fiellin DA, Weiss L, Botsko M, et al. Drug treatment outcomes among HIV-infected opioid-dependent patients receiving buprenorphine/naloxone. *J Acquir Immune Defic Syndr.* Mar; 2011 56( Suppl 1):S33–38. [PubMed: 21317592]

**Table 1**  
**HIV Quality of Care Indicators**

Quality indicators were assessed for each participant in the 12 months following their baseline survey date.

Quality Indicator	“Pass” Criteria	Eligibility Criteria
Medications		
ART	Receipt of ART in past 12 months	CD4 nadir 350 cells/mL <sup>3</sup> ever
PCP proph	Receipt of dapsone, tmp/smx, atovaquone, pentamidine in 12 months	CD4 count 200 cells/mL <sup>3</sup> in 12 months
MAC proph	Receipt of clarithromycin, azithromycin, or rifabutin in 12 months	CD4 count 50 cells/mL <sup>3</sup> in 12 months
Screening		
Hyperlipidemia	Lipid test in 12 months	On ART
Hepatitis C	Hepatitis C antibody or RNA test, ever	All
Prevention		
Pneumovax	Pneumococcal vaccine, ever	All
Influenza	Influenza vaccine in 12 months	All
Monitoring		
CD4	2 CD4 counts performed in 12 months, at least 90 days apart	All
HIV Visits	2 HIV clinic visits in 12 months, at least 90 days apart	All

Table 2

Participant Characteristics, Overall and by Substance Use (n=3410).

	Overall		Current Unhealthy Alcohol Use		Current Illicit Drug Use		
	(n=3410)	Yes (n=864)	No (n=2483)	P value	Yes (n=967)	No (n=2355)	P value
Mean Age (SD)	49.1 (8.8)	48.1	49.5	<.001	48.6	49.2	.065
Male Gender (%)	97.4	98.4	97.1	.046	97.2	97.5	.689
Race/ethnicity				.845			<.001
White	19.6	19.1	20.0		12.8	22.8	
Black	67.0	67.9	66.7		75.6	63.1	
Latino	9.4	9.5	9.4		7.5	23.2	
Other	4.0	3.5	3.9		4.1	4.0	
CD4 > 200	75.9	74.6	76.5	.258	70.0	78.1	<.001
HIV RNA < 500	49.1	42.9	51.5	<.001	41.4	51.9	<.001
On Antiretrovirals	83.2	79.2	84.6	<.001	80.3	84.4	.004
> High School/GED	58.7	54.0	60.8	.001	52.5	61.9	<.001
Ever Homeless	42.1	47.6	40.1	<.001	22.8	8.0	<.001
HCV Positive	53.6	58.2	52.1	.002	66.8	48.1	<.001
Diabetes	19.9	10.1	21.5	<.001	14.3	20.0	<.001
Depression	22.2	27.6	20.5	<.001	31.3	18.6	<.001
Unhealthy Alcohol Use	25.8	-	-	-	39.7	20.6	<.001
Drug Use							
Opiates	9.5	13.0	8.4	<.001	33.6	-	
Cocaine	21.9	38.1	16.0	<.001	77.0	-	
Stimulants	4.3	6.4	3.7	.001	15.3	-	
Marijuana	27.7	38.8	23.6	<.001	49.6	-	



	Overall (n=3410)	Current Unhealthy Alcohol Use		Current Illicit Drug Use	
		Yes (n=864)	No (n=2483)	Yes (n=967)	No (n=2355)
			P value		P value
Injection Drug Use	7.1	10.5	6.1	25.1	<.001
					-

**Table 3**  
HIV Quality of Care Indicators and Summary Score, by Current Substance Use Status (n=3410)

	Overall		Recent Unhealthy Alcohol Use (n=3347)				Recent Illicit Drug Use (n=3322)				P value
	No. Eligible	% Received	Yes (n=864)	No. Eligible	% Received	No (n=2,483)	No. Eligible	% Received	Yes (n=967)	No. Eligible	
Mean % QIs Received (SD)	3410	81.5 (18.9)	78.4(20.4)	82.7(18.3)	<.001	83.1 (18.3)	<.001				<.001
On cART Therapy	1790	89.4	88.9	1295	89.6	.682	569	86.1	1176	91.2	.001
PCP Prophylaxis	786	91.9	91.4	559	92.3	.688	279	95.0	493	90.1	.016
MAC Prophylaxis	195	86.2	92.3	138	84.1	.140	77	96.1	115	79.1	.001
2 CD4 Counts	3410	77.6	71.5	2483	79.9	<.001	967	70.9	2355	80.0	<.001
2 HIV Visits	3410	87.1	82.8	2483	88.5	<.001	967	82.8	2355	88.7	<.001
HCV Screening	3410	95.2	94.8	2483	95.3	.526	967	95.6	2355	95.0	.492
Lipid Screening	2838	79.9	73.8	2100	81.7	<.001	776	73.1	1988	82.4	<.001
Pneumococcal Vaccine	3410	88.0	87.0	2483	88.2	.350	967	84.6	2355	89.3	<.001
Influenza Vaccine	3410	55.8	52.9	2483	57.1	.033	967	49.0	2355	58.6	<.001

**Table 4**

Bivariate and Multivariable Associations between Patient Characteristics and the Mean Percent of HIV Quality Indicators Received, if eligible (n=3410).

	Mean % QIs Received	Bivariate $\beta$ Coefficient (95% CI)	Multivariable $\beta$ Coefficient (95% CI)
Age (years)	p<.001		
<50 (n=1786)	79.8	1.0	1.0
50 (n=1624)	83.4	<b>3.62 (2.35, 4.89)</b>	<b>2.86 (1.54, 4.18)</b>
Race/Ethnicity	p<.001		
White (n=667)	84.2	1.0	1.0
Black (n=2,284)	80.9	<b>-3.31 (-4.94, -1.68)</b>	<b>-2.93 (-4.63, -1.21)</b>
Latino (n=322)	82.0	-2.18 (-4.69, 0.33)	-0.65 (-3.29, 1.98)
Other/Unk (n= 137)	78.6	<b>-5.56 (-9.03, -2.08)</b>	<b>-4.79 (-8.33, -1.25)</b>
Gender	p=.003		
Female (88)	76.3	1.0	1.0
Male (3322)	81.7	<b>5.35 (1.35, 9.36)</b>	<b>4.09 (0.07, 8.11)</b>
> High School Ed	p=.336		
No (n=1397)	81.4	1.0	--
Yes (n=1984)	81.7	0.31 (-0.99, 1.61)	
Ever Homeless	p<.001		
No (n=1966)	83.8	1.0	1.0
Yes (n=1431)	78.5	<b>-5.27 (-6.55, -4.00)</b>	<b>-3.39 (-4.73, -2.04)</b>
Hepatitis C +	p=.450		
No (n=1581)	81.5	1.0	--
Yes (n=1829)	81.6	0.01 (-1.27, 1.28)	
Diabetes	p<.001		
No (n=2781)	80.6	1.0	1.0
Yes (n=629)	85.8	<b>5.23 (3.60, 6.86)</b>	<b>4.17 (2.48, 5.85)</b>
Depression	p<.001		
No (n=2633)	82.1	1.0	1.0
Yes (n=749)	79.4	<b>-2.65 (-4.19, -1.11)</b>	-1.11 (-2.68, 0.45)
Unhealthy Alcohol Use	p<.001		
No (n=2483)	82.7	1.0	1.0
Yes (n=864)	78.4	<b>-4.28 (-5.74, -2.82)</b>	<b>-2.74 (-4.23, -1.25)</b>
Illicit Drug Use	p<.001		
No (n=2355)	83.1	1.0	1.0
Yes (n=967)	77.7	<b>-5.36 (-6.77, -3.95)</b>	<b>-3.51 (-4.99, -2.02)</b>
IDU in past 12 months	p=.005		

	Mean % QIs Received	Bivariate $\beta$ Coefficient(95% CI)	Multivariable $\beta$ Coefficient (95% CI)
No (n=3108)	81.8	1.0	--
Yes (n=239)	78.3	-3.52 (-6.01, -1.02)	