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Patterns of Alcohol Use Among Patients Living with HIV in Urban, Large Rural, and Small Rural Areas

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Abstract

Background: For people living with HIV (PLWH), alcohol use is harmful and may be influenced by unique challenges faced by PLWH living in rural areas. We describe patterns of alcohol use across rurality among PLWH.

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Methods: Veterans Aging Cohort Study electronic health record data were used to identify patients with HIV (ICD-9 codes for HIV or AIDS) who completed AUDIT-C alcohol screening between 2/01/08 and 9/30/14. Regression models estimated and compared 4 alcohol use outcomes [any use (AUDIT-C > 0) and alcohol use disorder diagnoses (AUD; ICD-9 codes for abuse or dependence) among all PLWH; and AUDIT-C risk categories: lower- (1–3 men/1–2 women), moderate- (4–5 men/3–5 women), higher- (6–7), and severe-risk (8–12), and heavy episodic drinking (HED; ≥1 past-year occasion) among PLWH reporting use] across rurality (urban, large rural, small rural) and census-defined region.

Findings: Among 32,699 PLWH (29,540 urban, 1,301 large rural, and 1,828 small rural), both any alcohol use and AUD were highest in urban areas, although this varied across region. Predicted prevalence of any alcohol use was 54.1% (53.5%−54.7%) in urban, 49.6% (46.9% −52.3%) in large rural, and 50.6% (48.3%−52.9%) in small rural areas ($P < .01$). Predicted prevalence of AUD was 14.4% (14.0%−14.8%) in urban, 11.8% (10.0%−13.5%) in large rural, and 12.3% (10.8%−13.8%) in small rural areas ($P < .01$). Approximately 12% and 25% had higher- or severe-risk drinking and HED, respectively, but neither differed across rurality.

Conclusion: Though some variation across rurality and region was observed, alcohol-related interventions are needed for PLWH across all geographic locations.

Keywords

alcohol use; HIV; rural; urban; veterans

Among people living with HIV (PLWH), alcohol use is associated with increased risk for a number of adverse HIV-related outcomes, including increased risk of HIV transmission, delayed entry to treatment, non-adherence to antiretroviral therapy (ART), increased disease progression, and mortality.[1–3] Because some risks are increased even at the lowest levels of alcohol consumption, no level of alcohol use appears to be “safe” for PLWH.[1] Risk of adverse outcomes is greater for those with higher severity (ie, “unhealthy alcohol use”) relative to those who drink at lower levels.[1,4] Unhealthy alcohol use ranges from drinking above recommended limits to meeting diagnostic criteria for alcohol use disorder (AUD)[5] and encompasses multiple patterns of drinking such as heavy episodic drinking and high average consumption level, which are negatively associated with a number of health outcomes.[3,6–8] Unhealthy alcohol use is also strongly associated with increased HIV transmission and incidence.[9–11] Given the dangers of any and unhealthy alcohol use for PLWH, understanding patterns of alcohol use may be important to providing effective interventions both to prevent and treat HIV.

Although historically in the US HIV has primarily affected those in urban areas,[12] HIV incidence in rural areas is growing, particularly in the South.[13,14] Previous studies in non-HIV-specific populations have identified variation in alcohol use patterns across rurality.[15–17] These studies have found that individuals in rural areas are more likely to abstain from alcohol use than those in urban areas. However, those living in rural areas who drink often drink alcohol at a similar or even higher consumption level; they drink more per occasion,[18,19] more often report heavy episodic drinking, and are more likely to drink frequently than those living in urban areas.[16] These findings may be due to differences in religiosity,[20]

population age,[21] geographic isolation,[22] economic conditions,[23] alcohol availability,[24] and enforcement of alcohol-related laws.[18]

It is not known whether such patterns also exist among PLWH, who have unique life experiences that may affect alcohol use (eg, through increased experience of HIV-related stigma, which may affect urban and rural PLWH in different ways). HIV prevalence is generally lower in rural areas, and discrimination against PLWH is often higher in areas with low HIV prevalence.[25] While rural communities are heterogeneous and experiences may vary across regions of the United States and socioeconomic status, in general, there is greater experience of HIV stigma among rural, relative to urban, PLWH.[25–27] Therefore, compared to urban PLWH, rural PLWH who do drink may drink more heavily to cope with the increased stigma they experience in rural areas.[28–30] As social norms and practices within rural areas, as well as HIV incidence, differ across regions in the US,[27,31] region may also influence the associations between rurality and patterns of alcohol use. Understanding variation in alcohol use patterns across rurality and region among PLWH may identify key targets for interventions aimed at improving alcohol- and HIV-related outcomes.

Therefore, we investigated patterns of alcohol use across rurality and region in a national sample of PLWH who receive care from the Veterans Health Administration (VA). We hypothesized that patterns of alcohol use would differ across rurality and specifically that, relative to PLWH living in urban areas, those living in areas that are more rural would be less likely to report any alcohol use but that current drinkers would be more likely to experience unhealthy patterns of use. Further, we hypothesized that these associations between rurality and alcohol use patterns would vary across regions of the US. While previous research examining regional differences in the association between rurality and alcohol use patterns is limited, we hypothesized that in the South, with higher religiosity, there would be lower use in rural areas, similar to a previous study in the general population.[16]

Methods

Data Source and Study Sample

This study used national VA data from the Veterans Aging Cohort Study (VACS), which is a prospective, observational cohort study of VA patients, and includes all patients who were diagnosed with HIV. Patients diagnosed with HIV had at least 2 outpatient or 1 inpatient code for either AIDS: International Classification of Disease 9th Edition (ICD-9-CM) 042 or HIV: ICD-9-CM V08 between 1997 and 2014.[32] Data for VACS were obtained from the VA Corporate Data Warehouse (CDW), a national VA data repository that houses clinical and administrative data for all VA patients and includes results of clinical alcohol screening with the Alcohol Use Disorders Identification Test Consumption (AUDIT-C) questionnaire for patients nationwide since January 2008.[33–35] For the present study, VACS data were obtained for all PLWH who had a documented residential zip code and documented AUDIT-C screening between 02/01/2008 and 9/30/2014. Residential zip codes were included if they corresponded to a rural and urban commuting area (RUCA) code and Census Zip Code Tabulation Area. This cross-sectional study collected data on all measures at the first AUDIT-C screen within the study period for each patient.

Measures

Rurality—Rurality was defined using RUCA codes, which are based on the zip code of the patient's residence.[36] RUCA codes include 33 codes developed by the Federal Office of Rural Health Policy, based on commuting times and proximity to urban areas.[36] We combined these to create 3 categories of rurality: 1) urban, 2) large rural, and 3) small rural (including small town/remote categories), as have been used in a previous study,[37] and recommended by the Washington, Wyoming, Alaska, Montana, and Idaho Rural Health Research Center.[38] Zip code was measured for each patient at the time of the AUDIT-C screening and RUCA codes were based on the 2010 decennial census and 2006–2010 American Community Survey.[39] *Region* was measured using 4 categories as designated by the US Census, and included Northeast, Midwest, South, and West.[16,18]

Patterns of Alcohol Use—Four measures were derived to reflect patterns of unhealthy alcohol use that have overlapping but independent influences on health.[5] These included any alcohol use, levels of alcohol use, any heavy episodic drinking, and alcohol use disorders (AUD). Measures were derived using both AUDIT-C results from the first documented screen during the study period as well as ICD-9-CM codes. Specifically, we measured *any alcohol use* indicated by AUDIT-C scores > 0 and *any AUD* based on documented ICD-9-CM codes for alcohol abuse or dependence (ICD-9-CM codes 303.9–303.92 or 305.0–305.02) in the year prior to the AUDIT-C among all PLWH.[40] Among those reporting any alcohol use (those with AUDIT-C > 0), 2 additional measures enabling assessment of unhealthy alcohol use were derived from the AUDIT-C. *Levels of alcohol use* were measured based on gender-specific AUDIT-C cut points indicating clinically meaningful levels of drinking.[34,41–43] These included lower-risk: AUDIT-C scores of 1–2 (women) or 1–3 (men); moderate risk: AUDIT-C scores of 3–5 (women) or 4–5 (men); higher-risk: AUDIT-C scores of 6–7; and severe-risk: AUDIT-C scores of 8–12, based on studies indicating that increasing AUDIT-C scores reflect increasing risk of multiple medical outcomes,[44,45] and symptoms of AUD.[34,42,43,46,47] Additionally, we used a dichotomous measure of any *heavy episodic drinking*, based on report of consuming 6 or more drinks on at least 1 occasion in the past year, using the third AUDIT-C question (including affirmative responses of "less than monthly" to "daily or almost daily"). This measure is strongly associated with increased risk of AUD,[48] as well as poor HIV-related outcomes.[49]

Sociodemographic Characteristics—Sociodemographic characteristics that may vary across rurality and region and influence differences in alcohol use were also measured. These included age (categorized as <50, 50–64, and ≥65), gender (male and female), race/ethnicity (black, Hispanic, white, and other race), and VA eligibility priority. VA eligibility priority was used as a proxy for individual-level socioeconomic status, similar to previous VA studies of AUD prevalence[50] and receipt of alcohol-related care.[51] VA eligibility priority is determined by a combination of service-connected disability and income; we categorized PLWH based on full coverage (most vulnerable), <50% service connected coverage, or no service connected coverage. Finally, we measured community-level socioeconomic status as quartiles of *community-level poverty* (ie, percentage of households under the federal poverty guideline within a zip code tabulation area, as estimated by the 5-year American Community Survey estimates for 2009–2013, divided into quartiles).

Analyses

We described and compared characteristics across rurality among all PLWH using Chi-square tests of independence. Next, logistic regression models were fit to compare any alcohol use (relative to no alcohol use) and diagnosed AUD (relative to none) across rurality. Among only PLWH reporting past-year alcohol use (AUDIT-C > 0), ordinal logit models were fit to compare level of alcohol use (relative to lowest level of alcohol use) across rurality, and logistic regression models were fit to compare heavy episodic drinking (relative to none). For all models, recycled predictions, allowing rurality to vary while leaving covariates fixed in the model, were used to obtain predicted prevalence and 95% confidence intervals (CIs) of each outcome across rurality.[52]

Overall differences across rurality were assessed using a global Wald Test for each model, and odds ratios with *P* values from Wald Tests were calculated to compare urban relative to large rural, urban relative to small rural, and large rural relative to small rural estimates for all outcomes. Because the primary aim of the study was to describe patterns of alcohol use across rurality among PLWH, models were initially run unadjusted to obtain actual prevalences. However, to optimally facilitate comparisons across rurality and region, we subsequently adjusted for sociodemographic factors that are associated with alcohol use and may vary across rurality and region. Findings from both sets of models are presented. To compare differences across rurality, effect sizes of observed differences were identified via assessment of the magnitude of the differences in predicted prevalence and confidence intervals, and odds ratios were used to compare all categories of rurality. Finally, because we hypothesized that differences in alcohol use patterns across rurality may vary based on region, we tested multiplicative interactions between rurality and region using Wald tests and estimated results (predicted prevalence and 95% CIs) stratified by region for outcomes with a significant interaction between rurality and region. Interactions were tested in adjusted models to optimally facilitate comparison across areas where populations may differ. All analyses were conducted using Stata V14 (StataCorp LLP, College Station, Texas).

Results

Among 31,906 PLWH who met eligibility criteria, 28,848 (90.4%) were living in urban, 1,267 (4.0%) were living in large rural, and 1,791 (5.6%) were living in small rural areas. Among all PLWH meeting eligibility criteria, 17,172 (53.8%) reported any alcohol use in the past year. Sociodemographic characteristics are described in Table 1, overall and across rurality. PLWH living in urban, large rural, and small rural areas differed in several key ways. PLWH living in urban areas were younger, more likely to be black or Hispanic, and more likely to be living in the Northeast and West. PLWH living in large rural areas were more likely to be in the oldest age group and from the South. Those living in small rural areas were more likely to be middle-aged, white, and living in the Midwest (Table 1).

Among all PLWH, the prevalence of any alcohol use differed significantly across rurality in unadjusted and adjusted models (Wald test $P < .001$ for both; Table 2). PLWH living in small and large rural areas had lower adjusted odds than those in urban areas of reporting any alcohol use (Table 3). Prevalence estimates from the adjusted model were similar in

magnitude to those in the unadjusted model. In the adjusted model, the difference between any alcohol use in urban relative to both rural areas was about 4 percentage points with adjusted predicted prevalences of 54.2% [95% Confidence Interval (CI): 53.6%−54.7%] for PLWH living in urban areas, 50.2% (95% CI: 47.5%−52.9%) for PLWH living in large rural areas, and 50.7% (95% CI: 48.4%−53.0%) for PLWH living in small rural areas (Table 2).

The prevalence of diagnosed AUD differed significantly across rurality in the unadjusted model (Wald test $P = .002$) with PLWH from urban areas having the highest prevalence (Table 2). The unadjusted predicted prevalence was 14.4% (95% CI: 14.0%−14.8%) in urban areas, 11.8% (95% CI: 10.0%−13.6%) in large rural areas, and 12.2% (95% CI: 10.7% −13.7%) in small rural areas. However, overall differences in prevalence of AUD across rurality were attenuated after adjustment for sociodemographic characteristics (Table 2). The adjusted predicted prevalence was 14.3% (95% CI: 13.9%−14.7%) in urban areas, 12.6% (10.7%−14.4%) in large rural areas, and 13.0% (11.4%−14.6%) in small rural areas. Similarly, while in the unadjusted comparisons across rurality, those in large and small rural areas had significantly lower odds of AUD, these differences were attenuated (and there were no statistically significant differences in odds) in the adjusted models (Table 3).

Among PLWH reporting any alcohol use, no statistically significant differences in either levels of alcohol use or heavy episodic drinking were observed overall across rurality in either unadjusted or adjusted models (Wald test P all > .05; Table 2). However, in the adjusted ordinal logit model, a statistically significant difference was observed between PLWH in urban and small rural areas, such that those in small rural areas had increased odds of being in a more severe AUDIT-C category relative to urban PLWH [AOR = 1.16 (95% CI: 1.01–1.35); Table 3].

The association between rurality and the outcomes was generally similar across region, though region significantly influenced the adjusted association between rurality and any alcohol use (P for interaction term = .009). Predicted prevalence of each of these outcomes for each geographic region and rurality specification are presented in Figure 1. In the South and West, patterns of any alcohol use were similar to those identified in main analyses (with prevalence being highest among PLWH living in urban areas), but, in the Midwest predicted prevalence was similar across rurality, and, in the Northeast, prevalence was higher in small rural and large rural areas relative to urban areas. There was not a significant interaction between region and rurality in predicting diagnosed AUD (P for interaction term = .144). Among those reporting any alcohol use, there were no significant interactions between rurality and region in predicting levels of alcohol use or heavy episodic drinking (P for interaction terms = .858 and .973, respectively).

Discussion

In this national study of PLWH receiving health care, alcohol use was common, with over half of the sample reporting any alcohol use, but minimal variation in patterns of alcohol use across rurality and region were identified. Findings suggest small, but statistically significant, variation in any alcohol use across rurality and region, with urban PLWH having the greatest

prevalence in the Northeast. Several domains of unhealthy alcohol use were also common. About 12%−14% of PLWH were diagnosed with AUD across rurality categories, with small but statistically significant differences in the unadjusted model such that those in urban areas were more likely to be diagnosed with AUD. Among PLWH reporting any alcohol use, approximately 12% reported higher-risk or severe-risk levels of alcohol use, with small but statistically significant differences in the adjusted model such that PLWH in small rural areas were more likely to use alcohol at higher levels. Approximately 25% of those reporting any alcohol use also reported heavy episodic drinking, but there were no differences across rurality.

The prevalence of any alcohol use among PLWH was about 54% across rurality in the present study. The estimated prevalence of any alcohol use among PLWH is similar to estimates in the US general population,[16,53] and the general VA clinical population.[17] Results are also similar to previous estimates in HIV-specific populations, including a previous study in a general sample of US residents with HIV, in which 52% reported any alcohol use.[53] Additionally, findings are consistent with previous research identifying a lower prevalence of any alcohol use among people living in rural areas relative to those living in urban areas,[16,17] although we found some regional variation.[16] Similar to these previous evaluations of rural and regional differences in non-HIV-specific populations, in our national sample of VA PLWH, reported prevalence of any alcohol use was lowest among PLWH living in small rural areas in the South.[16] Overall, these findings suggest that those in urban areas are least likely to be abstinent.

Differences in any alcohol use across rurality may also account for observed differences in unadjusted prevalence of diagnosed AUD across rurality in this sample. Specifically, those in rural areas were less likely to be diagnosed with AUD. This may be due to lower underlying prevalence and/or lower detection rates in rural areas. However, adjustment for sociodemographic factors attenuated this difference in AUD prevalence, indicating that heterogeneity in characteristics of persons living in these communities (ie, differences in demographic characteristics such as age and race/ethnicity) may also account for some of the differences. Adjusted findings of no difference in diagnosed AUD prevalence across rurality were similar to findings of a previous non-HIV-specific VA study in a primary care population, which found no differences in AUD prevalence across rurality.[17]

Among those reporting any alcohol use, unhealthy alcohol use patterns were similar across rurality, with one exception. Living in a small rural area was associated with increased odds of being in a more severe AUDIT-C category only in the adjusted (and not unadjusted) model. Therefore, while sociodemographic factors may account for some differences in unhealthy alcohol use, PLWH in small rural areas may also be at increased risk of unhealthy alcohol use relative to those in urban areas independent of rural/urban differences in sociodemographic characteristics. However, no differences in heavy episodic drinking were observed across rurality. Predicted prevalences of similar unhealthy alcohol use across rurality are consistent with those of a previous non-HIV-specific study of a VA primary care population,[17] but findings of some small additional increased risk associated with living in rural areas are similar to studies in the US general population, which demonstrated a similar

or higher prevalence of measures of unhealthy alcohol use among persons reporting any alcohol use in rural areas relative to those in urban or suburban areas.[16,18,19]

Although little variation in alcohol use was identified across rurality in this study of PLWH, alcohol use was very common, as were indicators of unhealthy alcohol use across rurality. These findings underscore the need for alcohol interventions among PLWH regardless of location. However, it may be that alcohol interventions for PLWH are (or are perceived to be) less available in resource-constrained rural areas.[54] Similarly, high prevalence of any and unhealthy alcohol use may be especially concerning for PLWH living in rural areas due to unique risks facing PLWH. Specifically, the confluence of unhealthy alcohol use and small social networks in rural areas may contribute to increased HIV incidence in rural areas due to poor viral control and increased HIV transmission risk behaviors within small networks.[55–58] Moreover, PLWH living in rural areas have increased access barriers to both alcohol and HIV-related care,[27,59] which could result in greater risk of adverse outcomes associated with alcohol use. Innovative methods to address resource constraints and rural barriers to both HIV and alcohol-related care, such as telemedicine,[60] travel reimbursements,[61] or filling prescriptions through the mail[62] may be needed. Despite similar levels of unhealthy alcohol use across rural areas, PLWH in rural areas may constitute a particularly vulnerable population in need of targeted alcohol interventions.

Limitations

There are several limitations to this study. Measurement of alcohol use based on clinically documented AUDIT-C screens may have resulted in under-identification of PLWH with unhealthy alcohol use due to methods of screening administration,[63–65] or limited patient recall or social desirability bias,[66] particularly in rural areas where stigma may be greater. Further, though alcohol screening is prompted by clinical reminders routinely in VA primary care settings, their use may be more variable across rurality and in infectious disease and/or HIV clinics where veterans with HIV may receive much of their care, especially in rural settings. Although a previous study conducted in a national sample of VA outpatients found that over 90% of patients received an annual screen,[67] and one study in a sample of VA patients with HIV found that 87% received at least one annual AUDIT-C screen during the study period,[68] differences in screening rates across rurality have not been described among PLWH. If veterans living with HIV in rural areas are less likely than their urban counterparts to receive alcohol screening, alcohol use may be under-captured among PLWH living in rural areas. Similarly, AUD may be under-recognized and thus under-diagnosed,[8] and it is possible that this varies across rurality, leading to under-identification of AUD among rural PLWH. Additionally, we did not include adjustment for comorbid conditions that are common among PLWH, such as Hepatitis C and other liver conditions. These conditions may differ by rurality[69] and influence alcohol use or report of alcohol use,[70] and thus they may account for any observed differences in alcohol use patterns across rurality. However, we did not adjust for these conditions because our study was descriptive and the association between many comorbid conditions and alcohol use could be bi-directional (ie, may be alcohol-attributable in addition to influencing subsequent abstinence).[71] In addition to confounding by unmeasured comorbidities, there may be residual confounding due to factors not available in VA electronic medical records. For example, while we used VA

eligibility priority as a proxy for socioeconomic status and included a measure for community-level poverty, it is an imperfect estimation. Because individual-level socioeconomic status is a probable confounder in the association between rurality and both HIV alcohol-related outcomes,[72] residual confounding by socioeconomic status may be present. Finally, as participants in this study were veterans who were linked with care who received an AUDIT-C screen, these results may not be generalizable to non-veterans, veterans not linked with care, veterans who did not receive an AUDIT-C screen, or PLWH who are not veterans.

Conclusion

Despite its limitations, this study contributes to the literature in several ways. The impact of rurality on patients with chronic conditions including HIV and substance use problems is a high-priority area of public health research.[8] To our knowledge, this study represents the first analysis of alcohol use patterns across rurality among PLWH. The prevalence of any alcohol use across levels of rurality was high, and there were also some small but statistically significant differences observed across both rurality and region. In adjusted models, although PLWH in rural areas were less likely to report any alcohol use than those in urban areas, diagnosed AUD prevalence overall was similar, and the prevalence of unhealthy alcohol use among PLWH reporting any alcohol use was similar or slightly higher for rural relative to urban PLWH. These findings highlight the importance of addressing alcohol use and related problems among PLWH in both urban and rural areas. Future studies are needed to explore additional factors associated with alcohol use patterns among PLWH, especially factors that may increase rural alcohol-related risk, such as HIV stigma, resource constraints, and social isolation. Targeted alcohol use interventions may be needed to provide equitable treatment access across rurality, particularly in resource-constrained small rural areas.

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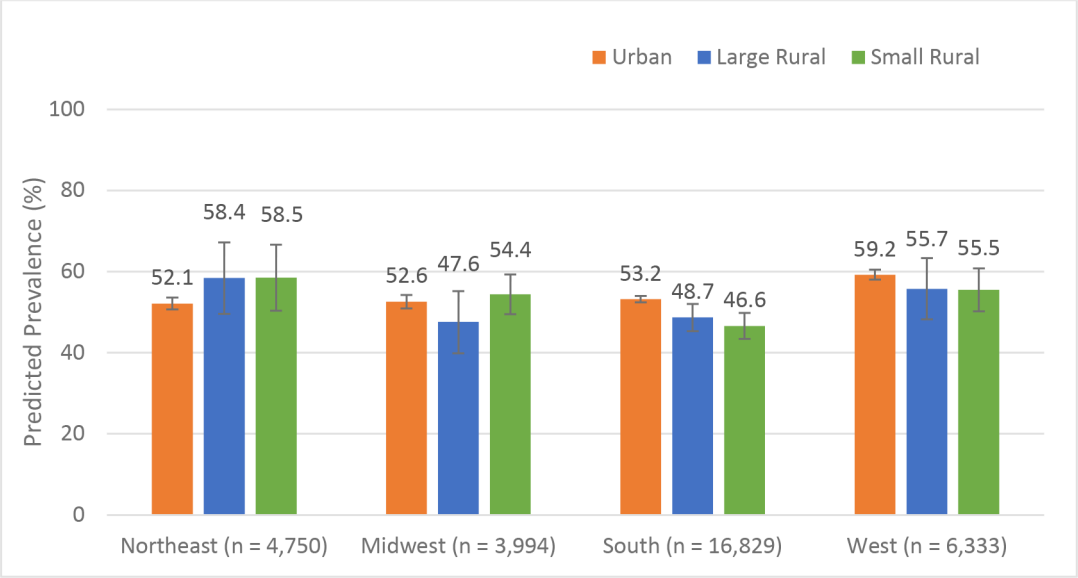

[a]Adjusted for age, gender, race/ethnicity, VA eligibility status, and community level poverty (*P* value for interaction = .009)

Figure 1:
Predicted Prevalence of Any Alcohol Use Across Rurality Stratified by Region Among PLWH at First AUDIT-C between 02/01/2008–09/30/2014 (n = 31,906)[a]

Table 1.

Descriptive Characteristics Overall and Compared Across Rurality among VA Patients Living with HIV at time of first AUDIT-C screening

	Overall N=31,906		Urban N=28,848		Large Rural N=1,267		Small Rural N=1,791		*P*
	N	(%)	N	(%)	N	%	N	%	
Female	949	(3)	863	(3)	30	(2)	56	(3)	.409
Age									
<50	11,523	(36)	10,515	(36)	397	(31)	611	(34)	< .001
50–64	17,074	(54)	15,382	(53)	696	(55)	996	(56)	
65+	3,309	(10)	2,951	(10)	174	(14)	184	(10)	
Race/ethnicity									
White	13,013	(41)	11,260	(39)	704	(56)	1,049	(59)	< .001
Black	15,596	(49)	14,526	(50)	466	(37)	604	(34)	
Hispanic	2,178	(7)	2,060	(7)	47	(4)	71	(4)	
Other	1,119	(4)	1,002	(4)	50	(4)	67	(4)	
VA Eligibility Priority									
Full	8,232	(26)	7,401	(26)	345	(27)	486	(27)	.046
<50% SC	6,256	(20)	5,715	(54)	238	(19)	303	(17)	
Non SC	17,358	(54)	15,675	(54)	682	(54)	1,001	(56)	
Missing	60	(0.2)	57	(0.2)	2	(0.2)	1	(0.1)	
Quartiles of % of Households Under the Poverty Threshold									
Lowest Quartile	8,047	(25)	7,535	(26)	208	(16)	304	(17)	< .001
Second Quartile	8,031	(25)	7,044	(24)	390	(31)	597	(33)	
Third Quartile	7,925	(25)	6,291	(24)	435	(34)	569	(32)	
Fourth Quartile	7,903	(25)	7,348	(26)	234	(19)	321	(18)	
Region									
Northeast	4,750	(15)	4,494	(16)	119	(9)	137	(8)	< .001
Midwest	3,994	(13)	3,448	(12)	160	(13)	386	(22)	
South	16,829	(53)	15,065	(52)	826	(65)	938	(52)	
West	6,333	(20)	5,841	(20)	162	(13)	330	(18)	

Notes: AUDIT-C = Alcohol Use Disorders Identification Test Consumption questionnaire. SC = Service Connected.

Table 2.

Predicted Prevalence of Any Alcohol Use and Alcohol Use Disorders among All PLWH (n = 31,906), and of Levels of Alcohol Use and Heavy Episodic Drinking among PLWH Reporting Any Alcohol Use (n = 17,172)

	Among All PLWH (n = 31,906)						
	Urban (n = 28,848)		**Large Rural (n = 1,267)**		**Small Rural (n = 1,791)**		Overall significance * *P*
Any Alcohol Use							
Unadjusted	54.2	(53.6–54.8)	49.6	(46.9–52.4)	50.6	(48.3–53.0)	< .001
Adjusted	54.2	(53.6–54.7)	50.2	(47.5–52.9)	50.7	(48.4–53.0)	< .001
Alcohol Use Disorder							
Unadjusted	14.4	(14.0–14.8)	11.8	(10.0–13.6)	12.2	(10.7–13.7)	.002
Adjusted	14.3	(13.9–14.7)	12.6	(10.7–14.4)	13.0	(11.4–14.6)	.082
	Among PLWH Reporting Any Alcohol Use (n = 17,172)						
	Urban (n = 15,636)		**Large Rural (n = 629)**		**Small Rural (n = 907)**		*P*
AUDIT-C categories (unadjusted)							
1–2 (men), 1–3 (women)	73.1	(72.4–73.8)	71.5	(68.1–75.0)	70.4	(67.5–73.3)	.138
3–5 (men), 4–5 (women)	15.1	(14.6–15.7)	15.9	(14.2–17.5)	16.4	(15.0–17.8)	
6–7 (all)	4.9	(4.6–5.2)	5.2	(4.4–6.0)	5.5	(4.8–6.2)	
8–12 (all)	6.8	(6.4–7.2)	7.3	(6.1–8.6)	7.7	(6.7–8.8)	
AUDIT-C Categories (adjusted)							
1–2 (men), 1–3 (women)	73.1	(72.4–73.8)	71.2	(67.7–74.7)	70.1	(67.1–73.0)	.080
3–5 (men), 4–5 (women)	15.1	(14.6–15.7)	16.0	(14.4–17.7)	16.5	(15.1–17.9)	
6–7 (all)	4.9	(4.6–5.2)	5.3	(4.5–6.1)	5.5	(4.9–6.2)	
8–12 (all)	6.8	(6.4–7.2)	7.5	(6.2–8.7)	7.9	(6.8–8.9)	
Any Heavy Episodic Drinking							
Unadjusted	24.0	(23.3–24.6)	24.2	(20.8–27.5)	25.5	(22.6–28.3)	.583
Adjusted	23.9	(23.2–24.5)	25.2	(21.8–28.6)	26.0	(23.2–28.9)	.274

Notes: PLWH = people living with HIV. AUDIT-C = Alcohol Use Disorders Identification Test Consumption questionnaire.

* *P* values from Wald Test for global significance

Table 3.

Odds Ratios of Any Alcohol Use and Alcohol Use Disorders Among All PLWH (n = 31,906), and of Levels of Alcohol Use and Heavy Episodic Drinking Among PLWH Reporting Any Alcohol Use (n = 17,172) Comparing Urban and Large Rural, Urban and Small Rural, and Small Rural vs Large Rural PLWH

	Among All PLWH (n = 31,906)					
	Large Rural vs Urban		**Small Rural vs Urban**		**Small Rural vs Large Rural**	
	OR	**(95% CI)**	**OR**	**(95% CI)**	**OR**	**(95% CI)**
Any Alcohol Use						
Unadjusted	0.83*	(0.74–0.93)	0.87*	(0.79–0.95)	1.04	(0.90–1.20)
Adjusted	0.85*	(0.76–0.95)	0.87*	(0.79–0.95)	1.02	(0.88–1.18)
Alcohol Use Disorder						
Unadjusted	0.80*	(0.67–0.95)	0.83*	(0.71–0.95)	1.04	(0.83–1.29)
Adjusted	0.86	(0.72–1.02)	0.89	(0.77–1.03)	1.04	(0.83–1.30)
	Among PLWH Reporting Any Alcohol Use (n = 17,172)					
	Large Rural vs Urban		**Small Rural vs Urban**		**Small Rural vs Large Rural**	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
AUDIT-C categories (unadjusted)	1.08	(0.91–1.29)	1.14	(0.99–1.32)	1.06	(0.85–1.32)
AUDIT-C Categories (adjusted)	1.10	(0.92–1.31)	1.16*	(1.01–1.35)	1.06	(0.85–1.32)
Any Heavy Episodic Drinking						
Unadjusted	1.01	(0.84–1.22)	1.08	(0.93–1.27)	1.07	(0.85–1.36)
Adjusted	1.07	(0.89–1.30)	1.12	(0.96–1.31)	1.05	(0.82–1.33)

Notes: AUDIT-C = Alcohol Use Disorders Identification Test Consumption questionnaire. PLWH = people living with HIV.

*$P < .05$