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Gender and Alcohol Use: Influences on HIV Care Continuum in a National Cohort of Patients with HIV

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Abstract

Objectives: To investigate whether gender is associated with three recommended stages of the HIV care continuum and whether gender modifies known associations between level of alcohol use and HIV care among US veterans.

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Design: Retrospective cohort.

Methods: Veterans Aging Cohort Study data were used to identify Veterans Health Administration (VA) patients with HIV and AUDIT-C alcohol screening 2/1/2008–9/30/2014. Modified Poisson regression models estimated the relative risk and predicted prevalences of engagement in HIV care (documented CD4 cells/μl or viral load copies/mL lab values), ART treatment (≥1 prescription), and viral suppression (HIV RNA <500 copies/mL) in the year following AUDIT-C (1) for women compared to men, and (2) for each level of alcohol use compared to nondrinking among women and among men. A multiplicative interaction between gender and alcohol use was tested.

Results: Among 33,224 patients, women (n=971) were less likely than men (n=32,253) to receive HIV care (p-values<0.001). Respective predicted prevalences for women and men were 71.9% (95% CI: 69.1–74.7%) and 77.9% (77.5–78.4%) for engagement, 60.0% (57.0–73.14%) and 73.8% (73.4–74.3%) for ART treatment, and 46.4% (43.3–49.6%) and 55.8% (55.3–56.3%) for viral suppression. Although the interaction between gender and alcohol use was not statistically significant, stratified analyses suggested worse outcomes for women than men at higher levels of alcohol use.

Conclusions: In this large national cohort, women were less likely than men to be engaged in HIV medical care, prescribed ART, and virally suppressed. Interventions to improve HIV care for women are needed at all levels of alcohol use.

Keywords

Veterans; Women; HIV; Viral Load; Alcohol Drinking; Continuity of Patient Care; Social Determinants of Health

INTRODUCTION.

Despite medical advances that help improve health and slow transmission, HIV is common in the US [1]. To effectively treat and prevent HIV, the Joint United Nations Programme on HIV and AIDS [2] recommends monitoring care targets considered essential, collectively referred to as the HIV care continuum [3]. These include: diagnosis, linkage to HIV care, engagement in care, treatment with antiretroviral therapy (ART), and achievement of viral suppression [2, 4].

In the US, HIV primarily affects men [1]. However, incidence in women rose in the last two decades [5], and, though now declining [1], women make up ~25% of people with HIV (PWH) [1]. For heterosexual acquisition, women are physiologically more susceptible to HIV than men [5, 6] and have increased exposure to social determinants of health that may increase treatment barriers and disease susceptibility [7, 8].

Women may also be more vulnerable than men to the impact of modifiable behavioral factors such as alcohol use that adversely affect HIV-related care and outcomes [9]. Whether gender modifies known associations between level of alcohol use and HIV care among US veterans is unknown. Understanding gender-specific effects of alcohol use on receipt of HIV

treatment and outcomes may help develop targeted interventions to increase engagement in HIV care and, ultimately, improve HIV-related outcomes for women and men.

As the nation's largest integrated health care system and largest provider of HIV care, the Veterans Health Administration (VA) is an ideal laboratory in which to address these issues [4, 10, 11]. In a national cohort of PWH receiving VA care we: (1) examine gender differences in HIV care continuum outcomes, and (2) assess whether gender modifies associations between level of alcohol use and HIV care continuum outcomes.

METHODS

Data Source and Study Cohort.

We used national VA electronic health records (EHR) data from the Veterans Aging Cohort Study (VACS) [10, 12] to identify all patients aged 25–84 with documented HIV and alcohol screening between 2/1/2008, when screening results became widely available [13], and 9/30/2014. International Classification of Disease, Ninth Revision, Clinical Modification (ICD-9-CM) codes determined HIV status based on two outpatient or one inpatient diagnosis code(s) for AIDS (042) and/or HIV infection (V08) [10, 14].

Measures.

Gender.—Gender was measured dichotomously as man or woman based on EHR documentation at the time of VACS enrollment.

Level of Alcohol Use.—Level of alcohol use was measured with the Alcohol Use Disorders Identification Test Consumption (AUDIT-C). The AUDIT-C is administered annually to >90% of established VA outpatients, with results documented in the EHR [15]. AUDIT-C scores range from 0–12 points; higher scores reflect greater consumption, probability of alcohol use disorder [16], and risk of mortality [17]. The first documented AUDIT-C after VACS enrollment was categorized into five levels of alcohol use: non-drinking (AUDIT-C 0), low (1–3 men/1–2 women), medium (4–5 men/3–5 women), high (6–7), and very high (8–12).

Outcomes.—Three HIV care continuum outcomes were measured in the year following AUDIT-C: 1) engagement in HIV care based on any documentation of CD4 (cells/μl) or HIV viral load (copies/mL) lab values [18]; 2) on ART, defined as having filled ≥1 prescription for any antiretroviral medication [18]; and 3) viral suppression measured as having HIV RNA <500 copies/mL [19] on the first available measure following AUDIT-C (<500 copies/mL has remained a target threshold over time even as assays have gotten more sensitive) [20].

Covariates.—Covariates included age at the time of alcohol screening (<50, 50–65, >65); race/ethnicity (black, Hispanic, white, and other/unknown) based on EHR documentation; year of AUDIT-C screening; and dichotomous measures of any mental health disorder (depressive disorder, anxiety, or serious mental illness including schizophrenia, bipolar, and schizoaffective disorders), alcohol use disorder (abuse, dependence, or alcohol-related conditions including cirrhosis), and drug use disorder (opioid, stimulant, cannabis, or other) based on ICD-9-CM codes in the year prior to AUDIT-C.

Analyses.

First, we compared cohort characteristics and level of alcohol use by gender using chi square tests. Next, we used modified Poisson regression models with robust error variances to estimate relative rates of HIV care continuum outcomes for women compared to men. Poisson was used because outcomes were expected to be common [21, 22]. Because we hypothesized *a priori* that gender would modify associations between level of alcohol use and HIV care outcomes, we also fit models that additionally included level of alcohol use and a multiplicative interaction between gender and alcohol use to estimate gender-specific effects of alcohol use. Non-drinking (AUDIT-C=0) was the referent category because research suggests this level is associated with the lowest level of risk for PWH [9]. We tested whether the relationship between level of alcohol use and each outcome was linear using orthogonal polynomial contrast tests. All models were first unadjusted and then adjusted for all covariates. Unadjusted models were considered primary because they reflect existing differences; adjusted models were fit to account for measured factors that may drive gender and alcohol-related differences in HIV care. To understand the clinical implications of differences in outcomes, we estimated predicted prevalences based on the unadjusted models using recycled predictions.

Because past-year non-drinking does not differentiate between lifetime abstainers and "sick-quitters," [23] we conducted sensitivity analyses excluding PWH reporting no alcohol use (AUDIT-C=0), with low-level drinking as the referent.

Analyses were conducted using Stata 14 software [24]. Study procedures were approved by VA Connecticut Healthcare System IRB.

RESULTS

Study Cohort Characteristics

Among 39,239 VA PWH alive at the start of the study period, 33,224 (85%) had AUDIT-C screening and were included in analyses. Of these, 971 were women and 32,253 were men. Sixty-four percent were 50 years and older, 48% were black race/ethnicity, and 36% reported any mental health disorder. Nearly half (47%) reported non-drinking and 39%, 8%, 3%, and 4% reported low-, medium-, high-, and very high-level drinking, respectively. On average, women were younger than men, more likely to be black race/ethnicity, have mental health disorders, and less likely to report medium-, high-, and very high-level drinking (Supplemental File 1).

Gender and HIV Care Continuum

Women were less likely than men to be engaged in HIV medical care, on ART, and virally suppressed (Table 1). Figure 1 shows the predicted prevalence of PWH receiving each element of the HIV care continuum by gender. Results were similar after adjustment.

Alcohol Use and HIV Care Continuum by Gender

There was no statistically significant interaction between level of alcohol use and HIV care continuum outcomes (in primary analyses, interaction term p-values were 0.30, 0.43 and

0.60 for engagement in HIV care, receipt of ART, and viral suppression, respectively). However, gender-stratified models suggested possible variability. Among women, very high-level drinking was associated with decreased likelihood of ART and viral suppression (but not engagement in HIV medical care) relative to non-drinking. Other levels of alcohol use were not associated with outcomes although numbers of women in these groups were small and confidence intervals wide (Table 1). Among men, relative to non-drinking, low-level drinking was associated with slightly *increased* likelihood of engaging in HIV medical care and ART while all other levels of alcohol use were associated with *decreased* likelihood of care continuum outcomes (Table 1).

Level of alcohol use was significantly inversely associated with all care continuum outcomes for both genders except engagement in HIV care among women. At every level of alcohol use, women had lower rates of HIV care continuum outcomes than men (Figure 1). All results were similar after adjustment.

Results of sensitivity analyses were comparable to primary results, although confidence intervals among women were much larger, likely due to reduced sample size (not shown).

DISCUSSION

In this large national cohort of PWH, gender disparities in key markers of effective HIV care were observed. Women were less likely than men to meet each HIV care continuum target, with fewer than half virally suppressed. At every level of alcohol use, women appeared to have poorer HIV care continuum outcomes than men. Further, the magnitude of reduction in rates of target care associated with very high-level drinking compared to non-drinking was much greater in women compared to men.

Gender-specific findings regarding level of alcohol use and HIV care continuum outcomes are concerning. Women with HIV may experience social vulnerabilities that increase alcohol-related risk and interfere with receipt of HIV care. In this cohort of women, almost two-thirds were black and half had clinically-identified mental health disorders. Both black race and mental health disorders are associated with stigma and discrimination that adversely influence HIV outcomes [1, 25–27]. Very high-level drinking adds synergistic risk [28, 29]. Women may also experience metabolic vulnerabilities whereby they suffer negative consequences of alcohol consumption faster and to a greater degree than men [30]. Such consequences have been documented for cognition, motor functioning, and reproductive health [30]. This is the first study to our knowledge to suggest that women with HIV and higher-level alcohol use may experience more severe HIV-related outcomes than men with the same conditions. Targeted interventions [31] may be needed to improve care and outcomes for women with HIV, particularly those with multiple and intersecting identities and comorbid conditions that increase risk.

This study has several limitations. First, power to detect associations between alcohol use and HIV care continuum outcomes among women may have been limited by smaller numbers of women with higher levels of alcohol use. Second, the EHR does not capture sexual orientation and may misclassify gender identity for some patients. Third, alcohol use

may have been underreported by patients [13, 32] and underestimated by clinically documented screening [33]. Fourth, the reference category (AUDIT-C=0) includes both PWH with lifetime abstinence and those who became abstinent due to declining health. The latter may be medically complex patients for whom additional barriers to HIV care exist [34]. However, sensitivity analyses with low-level drinking as the referent suggested similar patterns. Finally, although we studied a national cohort, findings may not be generalizable to non-VA populations. While racially and ethnically diverse, VA PWH may be older on average than PWH in the general population. Additionally, care that women with HIV receive at VA may differ from non-VA care (e.g., care by Ryan White services). Women receiving non-VA care may experience even greater disparities, given that VA is an integrated system with free HIV care. Alternatively, as a minority group in a health system traditionally serving men, women may face more barriers within VA.

This large nationally representative study builds on previous research by examining gender disparities across HIV care continuum outcomes [35] and provides further evidence [9] that alcohol use negatively impacts HIV care. Consistent with VA's commitment to continuous quality improvement, findings have been shared with HIV and women's health policymakers, and VA initiatives to address gender disparity in the care continuum are underway. Continued monitoring in VA and further research in other settings is needed. Services targeting women, regardless their level of alcohol use, may be needed to optimize HIV care.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Dr. Williams served as principal investigator of the study, guiding all stages of study design, analysis, interpretation and presentation. Dr. Justice serves as the principal investigator and Dr. Fiellin leads the Alcohol and Behavior Core of the Veterans Aging Cohort Study (VACS), which collected and provided study data and contributed structured review of results and interpretation. Ms. Matson wrote the manuscript in collaboration with Dr. Williams, revising it in accordance with contributions from all other authors. Dr. McGinnis completed all study analyses; Dr. Bensley and Ms. Frost contributed to literature review; all authors contributed to interpretation of findings, drafting and iterative review of the manuscript, and all authors approved the final manuscript.

Conflict of Interest and Source of Funding

This study was funded by a grant from the National Institute on Alcohol Abuse and Alcoholism (R21AA022866–01; Williams/Bradley PIs) and COMpAAAS/Veterans Aging Cohort Study (U24-AA020794, U01-AA020790, U01-AA020795, U01-AA020799; U10 AA013566). Dr. Williams is supported by a Career Development Award from VA Health Services Research & Development (CDA 12–276).

The funders of this study had no role in study design or data collection. An employee of the funder (K. Bryant) is a co-author on this manuscript and helped guide analysis, interpretation and presentation of data and participated in the decision to submit the manuscript for publication. For the remaining authors, none were declared.

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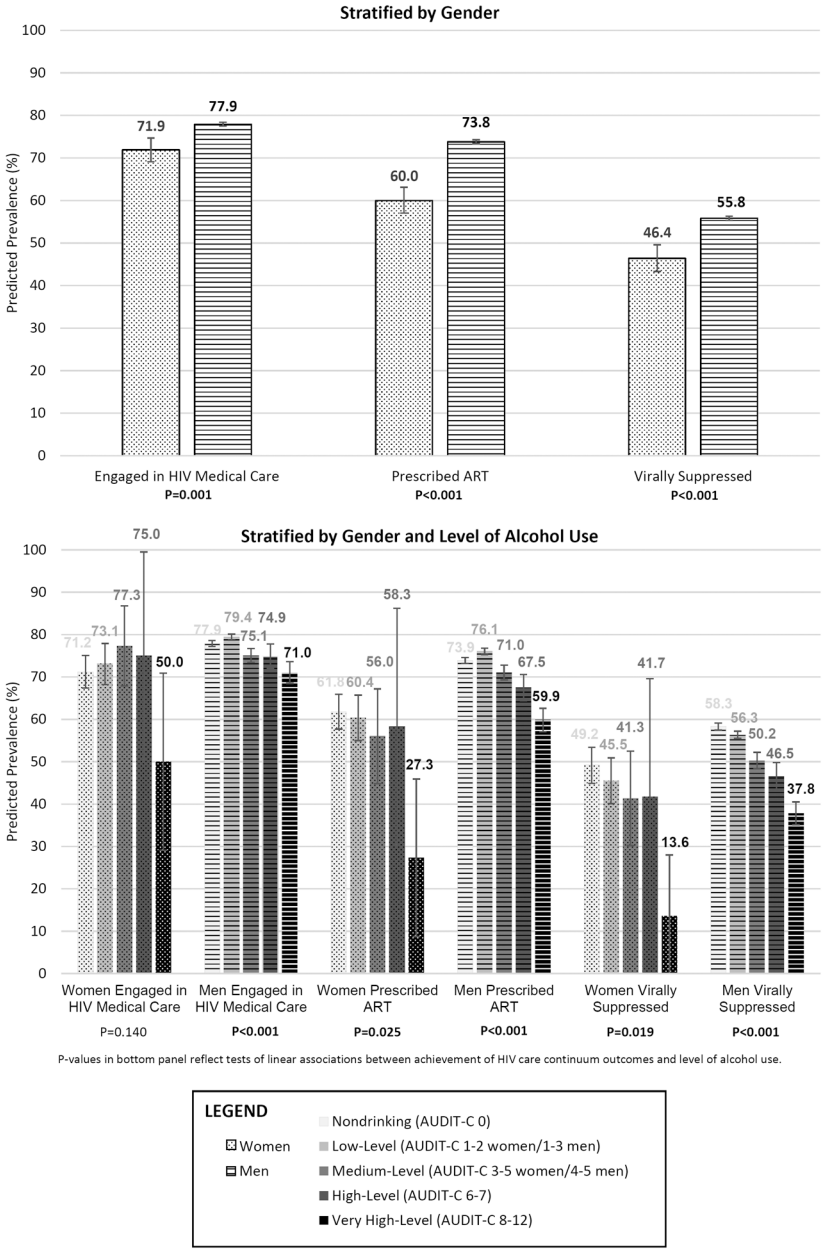

Figure 1.

Percent Achieving HIV Care Continuum Outcomes by Gender and Alcohol Use among US Veterans Health Administration Patients with HIV and Documented AUDIT-C Screening Between February 2008 and September 2014 (Women=971; Men=32,253).

TABLE 1.

Associations Between Gender, Level of Alcohol Use and 3 Measures of the HIV Care Continuum in a Large National Cohort of US Veterans Health Administration Patients with HIV and Documented AUDIT-C Screening Between February 2008 and September 2014 (Women = 971, Men = 32,253)

	Unadjusted				Adjusted*			
	RR	[95% CI]	p-value	Test for Linear Trend†	aRR	[95% CI]	p-value	Test for Linear Trend†
Engaged in HIV Medical Care N=25,833 (698 for women, 25,135 for men)								
WOMEN (relative to men)	0.92	[0.89,0.96]	<0.001	N/A	0.90	[0.86,0.94]	<0.001	N/A
Level of Alcohol Use‡								
Non-drinking (0)	--	ref	.	0.14	--	ref	.	0.13
Low-Level (1–2 women)	1.03	[0.94,1.12]	0.56		1.04	[0.96,1.14]	0.31	
Medium-Level (3–5 women)	1.09	[0.95,1.24]	0.23		1.09	[0.96,1.24]	0.17	
High-Level (6–7)	1.05	[0.76,1.47]	0.76		1.08	[0.78,1.49]	0.66	
Very High Level (8–12)	0.70	[0.46,1.07]	0.10		0.72	[0.47,1.08]	0.11	
MEN (referent)	--	--	.	N/A	--	--	.	N/A
Level of Alcohol Use§								
Non-drinking (0)	--	ref	.	<0.01	--	ref	.	<0.01
Low-Level (1–3 men)	1.02	[1.01,1.03]	0.00		1.02	[1.01,1.03]	0.00	
Medium-Level (4–5 men)	0.96	[0.94,0.99]	0.00		0.96	[0.94,0.98]	0.00	
High-Level (6–7)	0.96	[0.92,1.00]	0.05		0.95	[0.91,0.98]	0.00	
Very High Level (8–12)	0.91	[0.88,0.95]	0.00		0.89	[0.86,0.93]	0.00	
Prescribed ART N=24,400 (583 for women, 23,817 for men)								
WOMEN (relative to men)	0.81	[0.77,0.86]	<0.001	N/A	0.81	[0.77,0.85]	<0.001	N/A
Level of Alcohol Use‡								
Non-drinking (0)	--	--	.	0.03	--	--	.	0.04
Low-Level (1–2 women)	0.98	[0.87,1.09]	0.68		1.00	[0.90,1.12]	0.99	
Medium-Level (3–5 women)	0.91	[0.73,1.12]	0.36		0.91	[0.73,1.12]	0.36	
High-Level (6–7)	0.94	[0.58,1.53]	0.82		0.93	[0.57,1.52]	0.77	
Very High Level (8–12)	0.44	[0.22,0.88]	0.02		0.46	[0.23,0.91]	0.03	
MEN (referent)	--	--	.	N/A	--	--	.	N/A
Level of Alcohol Use§								
Non-drinking (0)	--	ref	.	<0.01	--	ref	.	<0.01
Low-Level (1–3 men)	1.03	[1.01,1.04]	0.00		1.02	[1.00,1.03]	0.02	
Medium-Level (4–5 men)	0.96	[0.94,0.99]	0.00		0.95	[0.93,0.98]	0.00	
High-Level (6–7)	0.91	[0.87,0.96]	0.00		0.91	[0.87,0.95]	0.00	
Very High Level (8–12)	0.81	[0.77,0.85]	0.00		0.82	[0.78,0.86]	0.00	
Viral Suppression								

	Unadjusted				Adjusted*			
	RR	**[95% CI]**	**p-value**	**Test for Linear Trend†**	**aRR**	**[95% CI]**	**p-value**	**Test for Linear Trend†**
N=18,449 (451 for women, 17,998 for men)								
WOMEN (relative to men)	0.83	[0.78,0.89]	<0.001	N/A	0.85	[0.79,0.91]	<0.001	N/A
Level of Alcohol Use‡								
Non-drinking (0)	--	ref	.	0.02	--	ref	.	<0.01
Low-Level (1–2 women)	0.93	[0.80,1.07]	0.30		0.96	[0.83,1.12]	0.62	
Medium-Level (3–5 women)	0.84	[0.63,1.12]	0.23		0.88	[0.66,1.16]	0.35	
High-Level (6–7)	0.85	[0.43,1.66]	0.63		0.87	[0.46,1.66]	0.68	
Very High Level (8–12)	0.28	[0.10,0.80]	0.02		0.31	[0.11,0.86]	0.02	
MEN (referent)	--	--	.	N/A	--	--	.	N/A
Level of Alcohol Use§								
Non-drinking (0)	--	ref	.	<0.01	--	ref	.	<0.01
Low-Level (1–3 men)	0.97	[0.95,0.99]	0.00		0.99	[0.97,1.01]	0.27	
Medium-Level (4–5 men)	0.86	[0.83,0.90]	0.00		0.88	[0.85,0.92]	0.00	
High-Level (6–7)	0.80	[0.74,0.86]	0.00		0.82	[0.77,0.89]	0.00	
Very High Level (8–12)	0.65	[0.60,0.70]	0.00		0.68	[0.63,0.73]	0.00	

*Adjusted for race/ethnicity, gender, fiscal year of AUDIT-C screening, age, and any mental health and non-alcohol substance use disorders

†Linear trend tested using orthogonal polynomial contrasts

‡Ns = 539, 523, 75, 12, and 22 for no alcohol use, low-, mild-, moderate-, and high-severity alcohol use

§Ns = 14907, 12662, 2610, 873, and 1201 for no alcohol use, low-, mild-, moderate-, and high-severity alcohol use